

## SEQUENCE LISTING

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&lt;110&gt; DSM N.V.

&lt;120&gt; Genes encoding enzymes in the biosynthesis of pimarinin and applications thereof

&lt;130&gt; S-2959

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&lt;141&gt;

&lt;160&gt; 14

&lt;170&gt; PatentIn Ver. 2.1

&lt;210&gt; 1

&lt;211&gt; 5544

&lt;212&gt; DNA

&lt;213&gt; Streptomyces natalensis

&lt;220&gt;

&lt;221&gt; CDS

&lt;222&gt; (1)..(5544)

&lt;400&gt; 1

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1				5				10						15		
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Thr	Ala	His	Gly	Gly	Gly	Gly	Phe	Thr	Leu	Pro	Ala	Val	Phe	Glu	Ala	
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gcc	gtg	gaa	tcc	gcc	ccc	gac	gca	gtg	gcc	ctc	gtc	gac	ggc	acc	gtt	144
Ala	Val	Glu	Ser	Ala	Pro	Asp	Ala	Val	Ala	Leu	Val	Asp	Gly	Thr	Val	
		35				40						45				
cct	gga	cct	ggg	cgc	atg	tgg	cgc	gca	gac	gtc	gat	gcg	ctg	gcc	cgc	192
Pro	Gly	Pro	Gly	Arg	Met	Trp	Arg	Ala	Asp	Val	Asp	Ala	Leu	Ala	Arg	
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Leu	Pro	Asn	Cys	Gly	Arg	Phe	Pro	Thr	Leu	His	Leu	Ala	Val	Ala	Ala	
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gtc	gga	gcg	gta	ctg	ctg	ccc	atc	cac	cag	ggc	acc	ccg	ctc	ccg	gag	336
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Val	Asp	Ala	Leu	Leu	Thr	Arg	Ala	Glu	Pro	Ala	Leu	Leu	Val	Leu	Ser	
		115				120						125				
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Leu Asp Gly Leu Leu Ala Gly Trp Ala Gly Ser Gly Pro Arg Pro Val	
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Asp Val Thr Pro Asp Met Pro Leu Val Leu Val Pro Ser Ser Gly Thr	
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Pro Val Leu Thr Ala Cys Pro Met Thr His Leu Phe Gly Leu Gln Ser	
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Leu His Ala Ala Leu Phe Ala Ala Cys Thr Gln Val Leu Leu Thr Gly	
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Trp Asp Val Asp Arg Phe Leu Glu Gln Ala Arg Glu His Gly Pro Arg	
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Val Val Phe Ala Val Pro Ala Gln Leu Arg Asp Val Val Thr Arg Leu	
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Ala Gly Ala Ala Val Ala Pro Ala Leu Ala Val Arg Val Arg Ala Val	
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Glu Tyr Pro Cys Leu Val Val Thr Asp His Ala Asp Gly Thr Ile Gly	
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Lys Ile Pro Leu Glu Leu Val Thr Val Arg Glu Leu Pro Phe Ser Pro	
515 520 525	
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Ala Glu Glu Ala Leu Asp Leu Val Arg Asp Cys Val Gly Arg Val Leu	
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Ser Pro Asp Lys Asp Phe Arg Gln Leu Gly Leu Asp Ser Ile Gly Ala	
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Val Arg Leu Arg Asn Leu Leu Arg Glu Glu Thr Gly Leu Pro Leu Pro	
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Ala Thr Leu Ala Phe Asp Ser Pro Thr Pro Arg Ala Val Ala Arg Val	
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Leu Ala Glu Gln Glu Glu Pro Ser Gln Asp Glu Pro Arg Glu Asn Pro	
645 650 655	
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Asp Arg Gly Tyr Gly Thr Ser Ala Ser Ala Ala Pro Ser Ala Trp Glu	
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Ser Met Leu Ile Thr Gly Thr Ala Gly Ser Ala Val Ser Gly Arg Ile	
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Ala Tyr Thr Tyr Gly Leu Glu Gly Pro Ala Leu Thr Val Asp Thr Ala	
820 825 830	
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Ser Ser Ser Ser Leu Val Ala Leu His Leu Ala Cys Arg Ser Leu Arg	
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850 855 860	
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915	920	925		
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Gln Asp Gly Ala Ser Asn Gly Leu Thr Ala Pro Ser Gly Pro Ala Gln				
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Gln Arg Val Ile Arg Gln Ala Leu Ala Asp Ala Gly Leu Thr Pro Gln				
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Pro Ile Glu Ala Gln Ala Leu Leu Ala Thr Tyr Gly Gln Gln Arg Pro				
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Ala Lys Val Asp Trp Ser Ala Gly Ser Val Arg Leu Leu Thr Glu Ala				
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ccg gga gag gcg gcg gca ggg gcg cgg gcc gag gtt ccc gag gag gcg	3312			
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Gln Ala Leu Arg Leu Ala Asp Gln Val Ala Ala Asp Pro Gly Leu Arg	
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Ala Gln Asp Val Ala His Ala Leu Ala Thr Ser Arg Thr Leu His Arg	
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His Arg Ala Val Val Ser Gly Ser Asp Arg Ala Gln Met Leu Ala Ala	
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Ala Lys Arg Phe Gly Leu Gly Glu Arg Thr Ala Gly Val Thr Pro Asp	
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Asp Ser Ala Pro Gly Leu Leu Ala Phe Val Phe Ser Gly Gln Gly Ser	
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Pro His Gly Glu Glu Gly His Arg Thr Phe Lys Glu Met Gly Ile Asn	
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1845

&lt;210&gt; 2

&lt;211&gt; 1848

&lt;212&gt; PRT

&lt;213&gt; Streptomyces natalensis

&lt;400&gt; 2

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Val Gly Ala Val Leu Leu Pro Ile His Gln Gly Thr Pro Leu Pro Glu
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Val Asp Ala Leu Leu Thr Arg Ala Glu Pro Ala Leu Leu Val Leu Ser
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Ala Ala Gly Ser Asp Gly Leu Ala Thr Ala Arg Ser Leu Leu Glu Ser
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Val Pro Ser Leu Arg Gly Val Leu Leu Ala Gly Ala Ser Gly Asp Gly
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Glu Ser Gly Ser Val Gly Gly Gly Glu Ser Gly Ser Gly Arg Arg Ser
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Val Ser Ala Arg Pro Lys Leu Cys Val His Ser His Asp Gly Leu Leu
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Ser Asn Thr Ala Ala Val Thr Ala Glu Ala Ala Asp Ala Phe Asp Gly
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Pro Val Leu Thr Ala Cys Pro Met Thr His Leu Phe Gly Leu Gln Ser
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Leu His Ala Ala Leu Phe Ala Ala Cys Thr Gln Val Leu Leu Thr Gly
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Trp Asp Val Asp Arg Phe Leu Glu Gln Ala Arg Glu His Gly Pro Arg

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Gly Val Leu Gly Leu Arg Asp Ala Cys Thr Leu Val Ala Ala Arg Ser 1315	1320	1325
Arg Leu Met Gly Ala Leu Pro Pro Gly Gly Ala Met Val Ala Val Arg 1330	1335	1340
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Tyr Ala Ala Pro Ala Val Pro Leu Val Ser Thr Val Thr Gly Arg Pro 425	1430	1435 1440
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Arg Gln Ser Val Arg Phe Lys Asp Ala Ile Gly Arg Leu Arg Asp Glu 1460	1465	1470
Arg Val Thr Gly Phe Leu Glu Leu Gly Ala Glu Pro Ala Leu Thr Pro 1475	1480	1485
Met Ile Asp Glu Cys Leu Glu Ser Ala Asp Gly Gln Pro Gly Thr Ala 1490	1495	1500
Leu Val Pro Ser Leu Arg Ala Gly Val Pro Glu Arg Asp Ala Leu Leu 505	1510	1515 1520
Thr Ala Val Ala Arg Val His Ala Gln Gly Val Pro Val Asp Trp Asp 1525	1530	1535
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Ala Ala Asp Arg Gln Trp Phe Arg Phe Val Pro Asp Gln Gly Ala Pro 1555	1560	1565
Leu Thr Leu Ala Asp Arg Ser Leu His Leu Glu Gly Ala Ala His Leu 1570	1575	1580

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Asp	Leu	His	Glu	Thr	Arg	Gln	Gln	Leu	Asp	Glu	Thr	Glu	Ala	Lys	Gln	
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Arg	Glu	Pro	Leu	Ala	Ile	Val	Ser	Met	Ala	Cys	Arg	Phe	Pro	Gly	Gly	
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Val	Arg	Ser	Pro	Glu	Glu	Leu	Trp	Glu	Leu	Leu	Arg	Asp	Gly	Val	Asp	
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Ala	Val	Ser	Ser	Phe	Pro	Arg	Asn	Arg	Gly	Trp	Asp	Leu	Asp	Ala	Leu	
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Tyr	His	Ser	Asp	Pro	Ala	His	Gln	Gly	Thr	Ser	Tyr	Ala	Arg	Glu	Gly	
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gga	ttc	ctg	cat	gac	gcg	ggc	gag	ttc	gac	ccc	ggc	ttc	ttc	ggg	atc	336
Gly	Phe	Leu	His	Asp	Ala	Gly	Glu	Phe	Asp	Pro	Gly	Phe	Phe	Gly	Ile	
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Ser	Pro	Arg	Glu	Ala	Leu	Ala	Met	Asp	Pro	Gln	Gln	Arg	Leu	Leu	Leu	
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Glu	Thr	Ala	Trp	Glu	Ala	Val	Glu	Arg	Ala	Gly	Ile	Asp	Pro	Glu	Ser	
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Tyr	Asp	Ala	Glu	Gly	Arg	Arg	Arg	Ala	Asp	Glu	Val	Gly	Gly	His	Leu	
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Leu	Thr	Gly	Asn	His	Ile	Ser	Ile	Ala	Ser	Gly	Arg	Ile	Ser	Tyr	Val	
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Leu	Gly	Leu	Glu	Gly	Pro	Ala	Leu	Thr	Val	Asp	Thr	Ala	Cys	Ser	Ser	
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Ser	Leu	Val	Ala	Leu	His	Leu	Ala	Met	His	Ala	Leu	Arg	Arg	Asp	Glu	
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tgc	gcc	atg	gcc	ctg	gtg	ggc	ggc	gcg	acc	gtg	atg	tcc	acg	ccg	cag	720
Cys	Ala	Met	Ala	Leu	Val	Gly	Gly	Ala	Thr	Val	Met	Ser	Thr	Pro	Gln	
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Met Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg	
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Cys Lys Pro Phe Ala Ala Ala Ala Asp Gly Thr Gly Trp Ser Glu Gly	
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Val Gly Leu Leu Leu Val Glu Arg Leu Ser Asp Ala Val Arg Asn Gly	
275 280 285	
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Tyr Pro Val Leu Ala Val Leu Lys Gly Ser Ala Val Asn Gln Asp Gly	
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Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser Gln Gln Arg Val	
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Ile Arg Gln Ala Leu Thr Gly Ala Gly Leu Ala Ala Ser Asp Ile Asp	
325 330 335	
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Ala Val Glu Ala His Gly Thr Gly Thr Thr Leu Gly Asp Pro Val Glu	
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Ala His Ala Leu Leu Ala Thr Tyr Gly Gln Gln Arg Ala Ala Asp Arg	
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Pro Cys Gly Leu Gly Ser Met Lys Ser Asn Ile Gly His Thr Gln Ala	
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Ala Ala Gly Ile Ala Gly Val Met Lys Met Val Leu Ala Met Arg His	
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Asp Trp Ser Glu Gly Asn Ala Arg Leu Leu Ala Glu Pro Glu Pro Trp	
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Pro Ser Ala Gly Arg Pro Arg Arg Ala Ala Val Ser Ser Phe Gly Ile	
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Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Ala Pro Ala His Glu	
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465 470 475 480	



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Leu	Gly	Arg	His	Leu	Arg	Asp	Arg	Ala	Asp	Leu	Glu	Pro	Ala	Ala	Val	
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Ala	His	Ala	Leu	Ala	Asp	Thr	Arg	Thr	Leu	Met	Glu	His	Arg	Ala	Val	
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Gln	Thr	Ala	Tyr	Thr	Gln	Ala	Ala	Leu	Phe	Ala	Leu	Glu	Thr	Ala	Leu	
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Phe	Arg	Leu	Val	Glu	Ser	Trp	Gly	Val	Ala	Pro	Arg	Phe	Val	Ala	Gly	
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His	Ser	Ile	Gly	Glu	Leu	Thr	Ala	Ala	His	Val	Ser	Gly	Val	Leu	Thr	
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Leu	Glu	Asp	Phe	Arg	Arg	Val	Ala	Arg	Gly	Leu	Thr	Phe	His	Ala	Pro		
	770					775				780							
cgc	atc	ccc	gtg	gtg	tcc	acg	gtg	acc	ggc	gcg	ctc	gcc	acc	gaa	gac	2400	
Arg	Ile	Pro	Val	Val	Ser	Thr	Val	Thr	Gly	Ala	Leu	Ala	Thr	Glu	Asp		
	785				790				795					800			
gaa	ctg	cgc	tcg	ccc	gac	tac	tgg	gtg	cgg	cag	gtc	cgc	gaa	acc	gtc	2448	
Glu	Leu	Arg	Ser	Pro	Asp	Tyr	Trp	Val	Arg	Gln	Val	Arg	Glu	Thr	Val		
				805				810					815				
cgc	ttc	tgt	gct	gcc	gtg	cgc	acc	ctt	gag	gcc	gag	ggc	gtc	acc	acc	2496	
Arg	Phe	Cys	Ala	Ala	Val	Arg	Thr	Leu	Glu	Ala	Glu	Gly	Val	Thr	Thr		
			820					825					830				
ttc	gtg	gag	atc	ggc	acc	ggc	ggc	gtc	ctc	acc	ccc	atg	gtc	cag	gac	2544	
Phe	Val	Glu	Ile	Gly	Thr	Gly	Gly	Val	Leu	Thr	Pro	Met	Val	Gln	Asp		
	835					840						845					
tgt	ctg	acc	acc	ctc	gaa	gag	ccc	gtt	ctc	gtc	cct	ctg	ctg	cgc	acc	2592	
Cys	Leu	Thr	Thr	Leu	Glu	Glu	Pro	Val	Leu	Val	Pro	Leu	Leu	Arg	Thr		
	850					855					860						
ggc	cgc	ccc	gaa	acc	gtc	gct	ctc	acc	gag	ggc	gtc	gcc	acc	gcc	ttc	2640	
Gly	Arg	Pro	Glu	Thr	Val	Ala	Leu	Thr	Glu	Gly	Val	Ala	Thr	Ala	Phe		
	865				870				875					880			
gtg	cac	ggc	gtc	ccc	gtc	gac	cgg	tcc	gcc	ttc	ccg	ggc	gcg	ccc	ggc	2688	
Val	His	Gly	Val	Pro	Val	Asp	Arg	Ser	Ala	Phe	Pro	Gly	Ala	Pro	Gly		
				885				890					895				
acc	tcc	cgc	gcg	gac	ctg	ccc	acc	tac	gcc	ttc	cag	cgt	cag	tgg	tac	2736	
Thr	Ser	Arg	Ala	Asp	Leu	Pro	Thr	Tyr	Ala	Phe	Gln	Arg	Gln	Trp	Tyr		
			900					905					910				
tgg	ctg	gac	ccg	gcc	gac	cac	gac	gag	ggg	gag	gcg	gcc	gcc	gcc	gaa	2784	
Trp	Leu	Asp	Pro	Ala	Asp	His	Asp	Glu	Gly	Glu	Ala	Ala	Ala	Ala	Glu		
	915					920					925						
gcg	ggc	gag	gcc	gga	ttc	tgg	gcg	gcc	gtc	gaa	cgc	gag	gac	ctc	cag	2832	
Ala	Gly	Glu	Ala	Gly	Phe	Trp	Ala	Ala	Val	Glu	Arg	Glu	Asp	Leu	Gln		
	930					935				940							
gag	ctg	tcg	gcc	gtc	ctg	gcc	atc	gac	ggc	agc	gaa	gcg	gac	tcc	ctc	2880	
Glu	Leu	Ser	Ala	Val	Leu	Ala	Ile	Asp	Gly	Ser	Glu	Ala	Asp	Ser	Leu		
	945				950				955					960			
ggc	agc	ttc	ctg	ccc	acc	ctc	tcc	tcc	tgg	cgc	agg	cag	cgc	agg	acc	2928	
Gly	Ser	Phe	Leu	Pro	Thr	Leu	Ser	Ser	Trp	Arg	Arg	Gln	Arg	Arg	Thr		

965	970	975	
cag gcc gcc gcg gac cgc ttc agc tac cgc acc cac tgg gcc ccg cgc Gln Ala Ala Ala Asp Arg Phe Ser Tyr Arg Thr His Trp Ala Pro Arg 980 985 990			2976
acc gcc tcg ggc ggc ccc acc gcc acc ggg cac tgg ctc gtc gtc ctg Thr Ala Ser Gly Gly Pro Thr Ala Thr Gly His Trp Leu Val Val Leu 995 1000 1005			3024
ccc gaa ggc ggc acc gac gac ccg tgg acc gcc cgc ctc ctg gac gcg Pro Glu Gly Gly Thr Asp Asp Pro Trp Thr Ala Arg Leu Leu Asp Ala 1010 1015 1020			3072
ctg aac gac cag ggc ctg cac acc gac gta cgc gaa ctg ccc gcc gac Leu Asn Asp Gln Gly Leu His Thr Asp Val Arg Glu Leu Pro Ala Asp 1025 1030 1035 1040			3120
cac gag ccc gac gcc tgg ggc cga cac ccc gtg gac ggc gtg ctc tgt His Glu Pro Asp Ala Trp Gly Arg His Pro Val Asp Gly Val Leu Cys 1045 1050 1055			3168
ctg ctg gca ctc gac gag cgg ccc acc cgc tcc tgc cct ccg tac cgg Leu Leu Ala Leu Asp Glu Arg Pro Thr Arg Ser Cys Pro Pro Tyr Arg 1060 1065 1070			3216
cgc ggg ctg gcc gcc acc acc aac gct gct gcg cgc cct gag ggc gcg Arg Gly Leu Ala Ala Thr Thr Asn Ala Ala Ala Arg Pro Glu Gly Ala 1075 1080 1085			3264
ggc atc cag gca ccg ctg tgg tgc gtg acc cgc ggc gcc gtc gcc gtc Gly Ile Gln Ala Pro Leu Trp Cys Val Thr Arg Gly Ala Val Ala Val 1090 1095 1100			3312
gac cgg cac gag gcg ctc aag agc ccc tta cag gca cag aca tgg ggc Asp Arg His Glu Ala Leu Lys Ser Pro Leu Gln Ala Gln Thr Trp Gly 1105 1110 1115 1120			3360
ctg ggc cgg gtg gcc gcc ctg gag tcc ccg cag agc tgg ggc ggg ctc Leu Gly Arg Val Ala Ala Leu Glu Ser Pro Gln Ser Trp Gly Gly Leu 1125 1130 1135			3408
atc gac ctg ccc gac aac ctg gac gga cgg gcc gtc tcc gcg ctg ctg Ile Asp Leu Pro Asp Asn Leu Asp Gly Arg Ala Val Ser Ala Leu Leu 1140 1145 1150			3456
agc acc ctc gcc ggg gag gag gac cag gtc gcc gtc cgc ccc gcc ggg Ser Thr Leu Ala Gly Glu Glu Asp Gln Val Ala Val Arg Pro Ala Gly 1155 1160 1165			3504
gtc ttc gcc cgc cgc ctg gaa cgg atc aca ccc ggc ggc gac acc ggc Val Phe Ala Arg Arg Leu Glu Arg Ile Thr Pro Gly Gly Asp Thr Gly 1170 1175 1180			3552
gac cgg tgg agc acc cac ggc acc gtc ctg gtc acc ggc ggc acc ggt Asp Arg Trp Ser Thr His Gly Thr Val Leu Val Thr Gly Gly Thr Gly 1185 1190 1195 1200			3600
gcc ctc ggc gcg cac ctc gcc cac tgg ctg gcc gac gcc gga gcc gaa Ala Leu Gly Ala His Leu Ala His Trp Leu Ala Asp Ala Gly Ala Glu 1205 1210 1215			3648

cac ctc gtg ctc acc ggc cgc cgc ggc ccg cag gcc ccc ggc gca ccg His Leu Val Leu Thr Gly Arg Arg Gly Pro Gln Ala Pro Gly Ala Pro 1220 1225 1230	3696
gaa ctc gcg gcc gcc ctc acc gac cgg ggc gtc aag gtc acc ctc gcc Glu Leu Ala Ala Ala Leu Thr Asp Arg Gly Val Lys Val Thr Leu Ala 1235 1240 1245	3744
gcc tgc gac gcc gcc gac cgt gat gcg ctg gcg gcc gtc ctc gcg gac Ala Cys Asp Ala Ala Asp Arg Asp Ala Leu Ala Ala Val Leu Ala Asp 1250 1255 1260	3792
atc ccg ccg cac ctg ccg ctg acc ggc gtc gtc cac gcc gcg ggc gta Ile Pro Pro His Leu Pro Leu Thr Gly Val Val His Ala Ala Gly Val 1265 1270 1275 1280	3840
ctg gac gac ggc gta ctg gac gcg ctc acc ccc gag cgc ttc gag acc Leu Asp Asp Gly Val Leu Asp Ala Leu Thr Pro Glu Arg Phe Glu Thr 1285 1290 1295	3888
gta ctg cgc ccc aag gcg cgg gcc gca cag aac ctg cac gaa ctc acc Val Leu Arg Pro Lys Ala Arg Ala Ala Gln Asn Leu His Glu Leu Thr 1300 1305 1310	3936
cag gac ctc gac ctg gac cac ttc gtg ctg ttc tcc tcg atc gtc ggc Gln Asp Leu Asp Leu Asp His Phe Val Leu Phe Ser Ser Ile Val Gly 1315 1320 1325	3984
gtc ctg ggc aac gcc gga cag gcc aac tac gcc gcc gcc aac gcc tac Val Leu Gly Asn Ala Gly Gln Ala Asn Tyr Ala Ala Ala Asn Ala Tyr 1330 1335 1340	4032
ttg gac gcc ctc gcc gaa cac cgt ctc gcc cag ggg ctc ccg gcc acc Leu Asp Ala Leu Ala Glu His Arg Leu Ala Gln Gly Leu Pro Ala Thr 1345 1350 1355 1360	4080
tcc gtg tcc tgg ggc cct ggg cag gcg gcg gca tgg cac gac agc gac Ser Val Ser Trp Gly Pro Gly Gln Ala Ala Ala Trp His Asp Ser Asp 1365 1370 1375	4128
gcc gcc gac cgg atg agc cgc gac gga ctg ctg ccc atg gcc gcg gcc Ala Ala Asp Arg Met Ser Arg Asp Gly Leu Leu Pro Met Ala Ala Ala 1380 1385 1390	4176
ccg cgt cgc cgc cct gcg cca gcc ctc gcc cag ggc atg aca cag gtg Pro Arg Arg Arg Pro Ala Pro Ala Leu Ala Gln Gly Met Thr Gln Val 1395 1400 1405	4224
acc gtg gcc gac atc gac tgg agc gca tac gcc ccc gcc ctg acc gcc Thr Val Ala Asp Ile Asp Trp Ser Ala Tyr Ala Pro Ala Leu Thr Ala 1410 1415 1420	4272
gtc cgc ccc agc ccc ctc atc ggc gac ctg ccc gag gca cgc cgc gcg Val Arg Pro Ser Pro Leu Ile Gly Asp Leu Pro Glu Ala Arg Arg Ala 1425 1430 1435 1440	4320
ctc ggc ccc gca gaa ggc ccc cgc cgg gaa cgc tcc ccc ctg cgc gac Leu Gly Pro Ala Glu Gly Pro Arg Arg Glu Arg Ser Pro Leu Arg Asp 1445 1450 1455	4368

cgg atc ggc gca ctg ccg ccc gcc gaa cag gaa aag gca ttc ctg acc	4416
Arg Ile Gly Ala Leu Pro Pro Ala Glu Gln Glu Lys Ala Phe Leu Thr	
1460 1465 1470	
atg gtc agg gaa gag gcc gcg agg gta ctg gga cac ccc tcg ccg gac	4464
Met Val Arg Glu Glu Ala Ala Arg Val Leu Gly His Pro Ser Pro Asp	
1475 1480 1485	
acc gtc gat gcc caa cgc gcc ttc cgc gag cag ggg ttc gac tcc ctg	4512
Thr Val Asp Ala Gln Arg Ala Phe Arg Glu Gln Gly Phe Asp Ser Leu	
1490 1495 1500	
atg gcc gtc gac ctg cgc aac cgg ctc tcc gcc gcg acg ggc ctg cgg	4560
Met Ala Val Asp Leu Arg Asn Arg Leu Ser Ala Ala Thr Gly Leu Arg	
1505 1510 1515 1520	
ctg ccc gcc acc ctg ctg ttc gac cac ccc acc ccc ctt gcg gcc gcc	4608
Leu Pro Ala Thr Leu Leu Phe Asp His Pro Thr Pro Leu Ala Ala Ala	
1525 1530 1535	
gcc tgc ctg cgc tcc gaa gtc ctg ggc gcc gca gga ccc gcc acg gtc	4656
Ala Cys Leu Arg Ser Glu Val Leu Gly Ala Ala Gly Pro Ala Thr Val	
1540 1545 1550	
gtt cag gca tcg acc gcc gcc ctc gac gaa ccg gtg gcg atc atc ggc	4704
Val Gln Ala Ser Thr Ala Ala Leu Asp Glu Pro Val Ala Ile Ile Gly	
1555 1560 1565	
atg gcc tgc cgc ttc ccc ggc ggc gtg cac tca ccc gag gcc ctg tgg	4752
Met Ala Cys Arg Phe Pro Gly Gly Val His Ser Pro Glu Ala Leu Trp	
1570 1575 1580	
cgg ctg ctg gcc gag ggc ggc gac gcc atc acc ccc atg ccc gcc gac	4800
Arg Leu Leu Ala Glu Gly Gly Asp Ala Ile Thr Pro Met Pro Ala Asp	
1585 1590 1595 1600	
cgg ggc tgg gac ctg gac cgg ctc tac cac ccc gac ccc gac cac cag	4848
Arg Gly Trp Asp Leu Asp Arg Leu Tyr His Pro Asp Pro Asp His Gln	
1605 1610 1615	
ggc acc agc tac gcc cgc ggc ggc ggc ttc ctg gac ggc gcg gcc gac	4896
Gly Thr Ser Tyr Ala Arg Gly Gly Gly Phe Leu Asp Gly Ala Ala Asp	
1620 1625 1630	
ttc gac gcg gac ttc ttc ggc atc tcg ccg cgc gag gcc ctc gcc atg	4944
Phe Asp Ala Asp Phe Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met	
1635 1640 1645	
gac ccg cag cag cgg ctg ctc ctg gaa aca tgg gag gtg ctc gaa cag	4992
Asp Pro Gln Gln Arg Leu Leu Leu Glu Thr Trp Glu Val Leu Glu Gln	
1650 1655 1660	
gcg ggc atc gac ccg gaa tcc ctg cgg ggc agc agc acc ggt gtc ttc	5040
Ala Gly Ile Asp Pro Glu Ser Leu Arg Gly Ser Ser Thr Gly Val Phe	
1665 1670 1675 1680	
gcg ggc acc aac acc cag gac tac ggc acg gcc ctg gac gcg gca cag	5088
Ala Gly Thr Asn Thr Gln Asp Tyr Gly Thr Ala Leu Asp Ala Ala Gln	
1685 1690 1695	
gac gaa gcc ggc gga cac cgg ctc acc ggc aac gcg atg agc gtc gtc	5136

Asp Glu Ala Gly Gly His Arg Leu Thr Gly Asn Ala Met Ser Val Val	
1700 1705 1710	
tcc ggc cgg gtc tcc tac acc ttc ggc ttc gag gga ccg gcc ctc acc	5184
Ser Gly Arg Val Ser Tyr Thr Phe Gly Phe Glu Gly Pro Ala Leu Thr	
1715 1720 1725	
gtg gac acg gcg tgc tcc tcc tcg ctg gtg gcc ctg cac atg gcc gcg	5232
Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Met Ala Ala	
1730 1735 1740	
cag gcg ctg cgc cag ggc gaa tgc tcc ctg gcg gtc gcg ggc ggt gtg	5280
Gln Ala Leu Arg Gln Gly Glu Cys Ser Leu Ala Val Ala Gly Gly Val	
1745 1750 1755 1760	
acg gtg atg gcc acc ccg tcc tcc ttc gtg gag ttc gcc cgg cag cgc	5328
Thr Val Met Ala Thr Pro Ser Ser Phe Val Glu Phe Ala Arg Gln Arg	
1765 1770 1775	
ggg ctg gcc ccc gac ggc cgc tgc aag ccg ttc gcg gcg gcc gcc gac	5376
Gly Leu Ala Pro Asp Gly Arg Cys Lys Pro Phe Ala Ala Ala Ala Asp	
1780 1785 1790	
ggc acc ggc tgg agc gag ggc gtc ggc ctg ctg ctc gtg gaa cgg ctc	5424
Gly Thr Gly Trp Ser Glu Gly Val Gly Leu Leu Leu Val Glu Arg Leu	
1795 1800 1805	
agc gac gcc cgc cga aac ggc cac cag gtg ctc gcc gtc gtc cgc ggt	5472
Ser Asp Ala Arg Arg Asn Gly His Gln Val Leu Ala Val Val Arg Gly	
1810 1815 1820	
tcg gcg gtc aac cag gac ggc gcg tcc aac ggt ctg agc gca ccc agc	5520
Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Ser Ala Pro Ser	
1825 1830 1835 1840	
ggc ccg tcc cag cag cgg gtg atc cgg cag gcc ctg gcg aac gcc cgg	5568
Gly Pro Ser Gln Gln Arg Val Ile Arg Gln Ala Leu Ala Asn Ala Arg	
1845 1850 1855	
gtg gcc gcc tcc gag gtc gac gcc gtg gag gcc cac ggc acg ggc acc	5616
Val Ala Ala Ser Glu Val Asp Ala Val Glu Ala His Gly Thr Gly Thr	
1860 1865 1870	
acg ctc ggt gac ccg atc gag gcc cag gcg ctg ctg gcc acc tac ggc	5664
Thr Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu Leu Ala Thr Tyr Gly	
1875 1880 1885	
cag gag cgg ccg ctg ctg ctc ggc gcg gtg aag tcc aac ctc ggc cac	5712
Gln Glu Arg Pro Leu Leu Leu Gly Ala Val Lys Ser Asn Leu Gly His	
1890 1895 1900	
acc cag gcc gcc gcc ggt gtg gcg ggc gtg atg aag atg gtg ctg gcg	5760
Thr Gln Ala Ala Ala Gly Val Ala Gly Val Met Lys Met Val Leu Ala	
1905 1910 1915 1920	
atg cgg cac ggc atg ctg ccg cgc acc ctg cac gtc gac gag ccc acc	5808
Met Arg His Gly Met Leu Pro Arg Thr Leu His Val Asp Glu Pro Thr	
1925 1930 1935	
ggg cat gtc gac tgg acc gcg ggc gcg gtc gag ctg ctc acc gag cac	5856
Gly His Val Asp Trp Thr Ala Gly Ala Val Glu Leu Leu Thr Glu His	

1940	1945	1950	
acg gac tgg ccc gag acc ggc cac ccc cgg cgc gcc gcg gtc tcc gcg Thr Asp Trp Pro Glu Thr Gly His Pro Arg Arg Ala Ala Val Ser Ala 1955	1960	1965	5904
ttc ggc atc agc ggc acc aat gcg cac gtg gtg ctg gaa ctg ccc gca Phe Gly Ile Ser Gly Thr Asn Ala His Val Val Leu Glu Leu Pro Ala 1970	1975	1980	5952
gcc gaa cag ccc ttg gtc gaa cag ccc tcg gcc gcg gag ccc gac gcg Ala Glu Gln Pro Leu Val Glu Gln Pro Ser Ala Ala Glu Pro Asp Ala 1985	1990	1995	6000
ccg gcc acc gct ccc gac cgg acg ccc acc gcc tcc gac ggg acg gcg Pro Ala Thr Ala Pro Asp Arg Thr Pro Thr Ala Ser Asp Gly Thr Ala 2005	2010	2015	6048
ccg ctg ctg ctc tcc gcc aag agc gag agc gcc ctg cgc gcc cag gcg Pro Leu Leu Leu Ser Ala Lys Ser Glu Ser Ala Leu Arg Ala Gln Ala 2020	2025	2030	6096
gcc cgg ctg cac tcc cac ctg gag cgc gac ccc gcg ctc cgg ctc acg Ala Arg Leu His Ser His Leu Glu Arg Asp Pro Ala Leu Arg Leu Thr 2035	2040	2045	6144
gac gcc gcg tac acg ctg atg acg cac cgc acg gcc ttc gcc cac cgc Asp Ala Ala Tyr Thr Leu Met Thr His Arg Thr Ala Phe Ala His Arg 2050	2055	2060	6192
gcg gcc gtc cgc gcc gcc gac cac gaa gcc gcg ctg cgc gcc ctg acc Ala Ala Val Arg Ala Ala Asp His Glu Ala Ala Leu Arg Ala Leu Thr 2065	2070	2075	6240
gcc ctg gct gcg ggc gag gcc gac ccc gcc gtg gac acc ggc acc gcc Ala Leu Ala Ala Gly Glu Ala Asp Pro Ala Val Asp Thr Gly Thr Ala 2085	2090	2095	6288
cac acc ggc cgg gac gcc gtc ctc ttc tcc ggc cag gga tcg caa cgc His Thr Gly Arg Asp Ala Val Leu Phe Ser Gly Gln Gly Ser Gln Arg 2100	2105	2110	6336
atc gga atg ggc cgg gag ttg tcc ggc cgc tac ccg gtg ttc gca gag Ile Gly Met Gly Arg Glu Leu Ser Gly Arg Tyr Pro Val Phe Ala Glu 2115	2120	2125	6384
gcc ttc gac acc gtg tgc gcg gcc ttg gac gag cat ctg gac cgc ccc Ala Phe Asp Thr Val Cys Ala Ala Leu Asp Glu His Leu Asp Arg Pro 2130	2135	2140	6432
ctg cgg gac gtg gtc cgg ggc gag gac gag gag ctg ctg aac cgg acc Leu Arg Asp Val Val Arg Gly Glu Asp Glu Glu Leu Leu Asn Arg Thr 2145	2150	2155	6480
gtc tac gcc cag gcg ggg ctg ttc gcc atc gag gtg gcc ctc ttc cgg Val Tyr Ala Gln Ala Gly Leu Phe Ala Ile Glu Val Ala Leu Phe Arg 2165	2170	2175	6528
ctc gtg gag tcc tgg ggc gta cgg ccg cac tac gtg gcc ggg cat tcc Leu Val Glu Ser Trp Gly Val Arg Pro His Tyr Val Ala Gly His Ser 2180	2185	2190	6576

gtc ggc gag atc gcc gcc gcg cac gtc gcc ggg gtg ttc tcg ctg gcc Val Gly Glu Ile Ala Ala Ala His Val Ala Gly Val Phe Ser Leu Ala 2195 2200 2205	6624
gat gcc tgc gcg ctg gtg gcg gca cgc gga cgg ctg atg cag gcg ctg Asp Ala Cys Ala Leu Val Ala Ala Arg Gly Arg Leu Met Gln Ala Leu 2210 2215 2220	6672
ccc gcc ggc ggc gcg atg gcg gcg atc cgg gcg acg gag gac gaa gtc Pro Ala Gly Gly Ala Met Ala Ala Ile Arg Ala Thr Glu Asp Glu Val 2225 2230 2235 2240	6720
ctc ccg cac ctg gcg gac agc gtc tcg atc gcg gcc gtc aac ggc ccg Leu Pro His Leu Ala Asp Ser Val Ser Ile Ala Ala Val Asn Gly Pro 2245 2250 2255	6768
tcg tcg gtc gtc gtc tcc ggc gcc gag cac gcc gtg ctc tcc atc gcc Ser Ser Val Val Val Ser Gly Ala Glu His Ala Val Leu Ser Ile Ala 2260 2265 2270	6816
gcg cac ttc gag ggc gcg ggc cgc aag acc acc agg ctg cgg gtc tcg Ala His Phe Glu Gly Ala Gly Arg Lys Thr Thr Arg Leu Arg Val Ser 2275 2280 2285	6864
cac gcc ttc cac tcc ccg ctc atg gac ccg atg ctg gcc gac ttc cgc His Ala Phe His Ser Pro Leu Met Asp Pro Met Leu Ala Asp Phe Arg 2290 2295 2300	6912
gcc gtc gcc gag ggc ctg acc tac ggc gag ccg gag ctg gcc gtc gta Ala Val Ala Glu Gly Leu Thr Tyr Gly Glu Pro Glu Leu Ala Val Val 2305 2310 2315 2320	6960
tcg aac gtc acc ggc caa ctc gcc acc ccg gac cag ctg cgc acc ccc Ser Asn Val Thr Gly Gln Leu Ala Thr Pro Asp Gln Leu Arg Thr Pro 2325 2330 2335	7008
gag tac tgg gtg acc cat gtc cgc gcg gcg gtg cgc ttc gcg gac ggg Glu Tyr Trp Val Thr His Val Arg Ala Ala Val Arg Phe Ala Asp Gly 2340 2345 2350	7056
ata cgg gct ctg ggg gcg gaa ggg gtg acg cgg ttc ctc gaa ctc ggc Ile Arg Ala Leu Gly Ala Glu Gly Val Thr Arg Phe Leu Glu Leu Gly 2355 2360 2365	7104
ccg gac ggc gtc ctg tcg gcc ttg gcc agg gag tcg gca ccg gac gac Pro Asp Gly Val Leu Ser Ala Leu Ala Arg Glu Ser Ala Pro Asp Asp 2370 2375 2380	7152
gcc gtg tgc act ccc gtg ctg cgc aag gac cgc tcc gag gcg gcg acc Ala Val Cys Thr Pro Val Leu Arg Lys Asp Arg Ser Glu Ala Ala Thr 2385 2390 2395 2400	7200
ctc ctc gcg gcc ctg acg cac ctg cac gta cac gga acc gag atc gac Leu Leu Ala Ala Leu Thr His Leu His Val His Gly Thr Glu Ile Asp 2405 2410 2415	7248
tgg acc gcg ttc ctc gcc ggc cgc gac gcg cac gcc gtc gac ctg ccc Trp Thr Ala Phe Leu Ala Gly Arg Asp Ala His Ala Val Asp Leu Pro 2420 2425 2430	7296



acg tac gcc ttc cag cac cag cgg ttc tgg ccg acc ccc gac cac acc	7344
Thr Tyr Ala Phe Gln His Gln Arg Phe Trp Pro Thr Pro Asp His Thr	
2435 2440 2445	
cgc acc ggt gac ctg ggc gcc gtc ggc ctc gaa gcg acc ggg cac ccg	7392
Arg Thr Gly Asp Leu Gly Ala Val Gly Leu Glu Ala Thr Gly His Pro	
2450 2455 2460	
ctg ctg agc gcc gcc gtg gaa ctg ccg gac ggt gag ggc ctg ttg ttc	7440
Leu Leu Ser Ala Ala Val Glu Leu Pro Asp Gly Glu Gly Leu Leu Phe	
2465 2470 2475 2480	
acc acc cgc ctc tcg ctc cag acc cac ccc tgg ctg gcc ggg cac gtc	7488
Thr Thr Arg Leu Ser Leu Gln Thr His Pro Trp Leu Ala Gly His Val	
2485 2490 2495	
gtc atg ggc tcg gtc ctg ctg ccg ggg acg gcc ttc gcc gaa ctc gcc	7536
Val Met Gly Ser Val Leu Leu Pro Gly Thr Ala Phe Ala Glu Leu Ala	
2500 2505 2510	
ctc cgc gcc gcc gac gag gtg ggc tgc gac cgc gtc gac gaa ctg acc	7584
Leu Arg Ala Ala Asp Glu Val Gly Cys Asp Arg Val Asp Glu Leu Thr	
2515 2520 2525	
ctg gcc gcc ccg ctc gtc ctg ccc gag cac ggc ggc gta cag ctc cag	7632
Leu Ala Ala Pro Leu Val Leu Pro Glu His Gly Gly Val Gln Leu Gln	
2530 2535 2540	
ctg cgg gtg ggc ccc gcc gac gcg tcc ggc cgc cgc acc ctg acc gcc	7680
Leu Arg Val Gly Pro Ala Asp Ala Ser Gly Arg Arg Thr Leu Thr Ala	
2545 2550 2555 2560	
cgc tcc agg gcg gag ggc gac ggc gac cgc ccg tgg gtc cag cac gcc	7728
Arg Ser Arg Ala Glu Gly Asp Gly Asp Arg Pro Trp Val Gln His Ala	
2565 2570 2575	
acc ggc gtc ctc gcg gaa ggg gag tcg acg ccc gaa ccc ggc tac gac	7776
Thr Gly Val Leu Ala Glu Gly Glu Ser Thr Pro Glu Pro Gly Tyr Asp	
2580 2585 2590	
ttc cac acc gag tcc tgg ccg ccc gcc gac gcc gcg ccc gtc gaa ctg	7824
Phe His Thr Glu Ser Trp Pro Pro Ala Asp Ala Ala Pro Val Glu Leu	
2595 2600 2605	
tcc ggc ctc tac ccg gac ttc gcc gca cac ggt ttc gac tac ggt ccc	7872
Ser Gly Leu Tyr Pro Asp Phe Ala Ala His Gly Phe Asp Tyr Gly Pro	
2610 2615 2620	
cac ttc cag ggg ctg cgg acc gcc tgg cgc cga ggc gac gag gtg ttc	7920
His Phe Gln Gly Leu Arg Thr Ala Trp Arg Gly Asp Glu Val Phe	
2625 2630 2635 2640	
gcc gag gtc gcc ctg ccc gcc gag gcc gaa ggc gag gca tcc gcg tac	7968
Ala Glu Val Ala Leu Pro Ala Glu Ala Glu Gly Glu Ala Ser Ala Tyr	
2645 2650 2655	
gga ctc cat ccg gcg ctg ctc gac gcc gcc ctg cac gtc gtc gcg ttc	8016
Gly Leu His Pro Ala Leu Leu Asp Ala Ala Leu His Val Val Ala Phe	
2660 2665 2670	
aac gga gtg gac cgc ggc gtc gtg ccg ttc tcc tgg gag agc gtc gcg	8064

Asn Gly Val Asp Arg Gly Val Val Pro Phe Ser Trp Glu Ser Val Ala	
2675 2680 2685	
ctg cac gcc acc ggc gcc tcg gcc gta cgg atc cgg gtc gtc cgg cac	8112
Leu His Ala Thr Gly Ala Ser Ala Val Arg Ile Arg Val Val Arg His	
2690 2695 2700	
agc gcc gac acg gtc tcc gtg gat gtc gcc gac acc acc ggc gag ccc	8160
Ser Gly Asp Thr Val Ser Val Asp Val Ala Asp Thr Thr Gly Glu Pro	
2705 2710 2715 2720	
gtc gcc tcc atc ggc acg ctc gtc ctg cgg gcg gtc tcc gcc gac cag	8208
Val Ala Ser Ile Gly Thr Leu Val Leu Arg Ala Val Ser Ala Asp Gln	
2725 2730 2735	
ttg gcg ggc ggc gcg gac ccg gcc gtc cgc gat gcg ctg ttc cgc gtg	8256
Leu Ala Gly Gly Ala Asp Pro Ala Val Arg Asp Ala Leu Phe Arg Val	
2740 2745 2750	
cag tgg aac ccc gta cgc ctg ccc ccg gcc ggg gcc gcg gtg acc gtg	8304
Gln Trp Asn Pro Val Arg Leu Pro Pro Ala Gly Ala Ala Val Thr Val	
2755 2760 2765	
gcg acg ctc ggc tcc ctt gcc ggc gca ccg ttc gac ggc tac ccg gac	8352
Ala Thr Leu Gly Ser Leu Ala Gly Ala Pro Phe Asp Gly Tyr Pro Asp	
2770 2775 2780	
ctg gcg tcc ctg gcc cgg tcc ggt cgt gtg gcg ggt gcg gtg ctg gta	8400
Leu Ala Ser Leu Ala Arg Ser Gly Arg Val Ala Gly Ala Val Leu Val	
2785 2790 2795 2800	
ccg gtg gaa gcc ggt gcc ggc gag gtg gtg gcg gac gat gtc gtg ggg	8448
Pro Val Glu Ala Gly Ala Gly Glu Val Val Ala Asp Asp Val Val Gly	
2805 2810 2815	
gcg acg cac gca acg gcc gcc ccg gcg ctg gac ctg gcc cgg tcg tgg	8496
Ala Thr His Ala Thr Ala Ala Arg Ala Leu Asp Leu Ala Arg Ser Trp	
2820 2825 2830	
ctg gcc gat gac cgg ttc gcg gcc tcg cgc ctg gtg ttc gtg acg cgt	8544
Leu Ala Asp Asp Arg Phe Ala Ala Ser Arg Leu Val Phe Val Thr Arg	
2835 2840 2845	
ggc gcg gtg tcc ggt gcg gat ctc gcg ggt gcg gcg gtg tgg ggt ctg	8592
Gly Ala Val Ser Gly Ala Asp Leu Ala Gly Ala Ala Val Trp Gly Leu	
2850 2855 2860	
gtg cgg tcg gcg ctg tcg gag cac ccg gcc cgc ttc ggt ctg gtg gat	8640
Val Arg Ser Ala Leu Ser Glu His Pro Gly Arg Phe Gly Leu Val Asp	
2865 2870 2875 2880	
ctg gat gac gat gcc gaa ctg gcg ctg gtg cca cgg gtg ttg gcg tcg	8688
Leu Asp Asp Asp Ala Glu Leu Ala Leu Val Pro Arg Val Leu Ala Ser	
2885 2890 2895	
gat gag ccg cag ctg ctg gtg cgc ggt ggt gag gtg ctg gcg gcg cgg	8736
Asp Glu Pro Gln Leu Leu Val Arg Gly Gly Glu Val Leu Ala Ala Arg	
2900 2905 2910	
ctg gcc cgg gcg cag tcc tcg cac gcg gtg acc tgg gat ccg tcc ggc	8784
Leu Ala Arg Ala Gln Ser Ser His Ala Val Thr Trp Asp Pro Ser Gly	

2915	2920	2925	
acg gtg ctc gtc acc ggt ggc acg ggt ggt ctg ggc cgt gtg atg gca			8832
Thr Val Leu Val Thr Gly Gly Thr Gly Gly Leu Gly Arg Val Met Ala			
2930	2935	2940	
cgt cac ttg gtg gtg gaa cac ggg gta cgg aac ctg ctg ctg gtc agc			8880
Arg His Leu Val Val Glu His Gly Val Arg Asn Leu Leu Leu Val Ser			
2945	2950	2955	2960
cgc cgt ggg ccc gcc gcc gaa ggt gcc gaa gag ctg gtg acg gag ctc			8928
Arg Arg Gly Pro Ala Ala Glu Gly Ala Glu Glu Leu Val Thr Glu Leu			
	2965	2970	2975
cgg cac agc ggt gcc gaa gtg gcc gtc gaa gcc tgt gat gtc acc gac			8976
Arg His Ser Gly Ala Glu Val Ala Val Glu Ala Cys Asp Val Thr Asp			
	2980	2985	2990
gcg gcc gcc gtg gcc gac ctg gtg gcc cgg cac cgg atc agc gct gtg			9024
Ala Ala Ala Val Ala Asp Leu Val Ala Arg His Arg Ile Ser Ala Val			
	2995	3000	3005
gtg cat acg gcc ggt gtc ctg gat gac ggt gtg gtg gag tcg ctg aca			9072
Val His Thr Ala Gly Val Leu Asp Asp Gly Val Val Glu Ser Leu Thr			
	3010	3015	3020
ccg gag cgg ctg tcg gcg gtg ttg cgt ccg aag gtg gat gcg gcc tgg			9120
Pro Glu Arg Leu Ser Ala Val Leu Arg Pro Lys Val Asp Ala Ala Trp			
	3025	3030	3035
aac ctg cac gag gcg acc agg gat ctg gac ctg gac gcg ttc gtg gtc			9168
Asn Leu His Glu Ala Thr Arg Asp Leu Asp Leu Asp Ala Phe Val Val			
	3045	3050	3055
ttc tcc tca gtg gca ggc acg atc ggg agc ccc ggt cag gcc aac tac			9216
Phe Ser Ser Val Ala Gly Thr Ile Gly Ser Pro Gly Gln Ala Asn Tyr			
	3060	3065	3070
gcg gcg ggc aac gcc ttc ctg gat gcc ctg gcc cac cac cgt cgg gcg			9264
Ala Ala Gly Asn Ala Phe Leu Asp Ala Leu Ala His His Arg Arg Ala			
	3075	3080	3085
gcg ggt ctt ccg gcg gcg tcg ctg gca tgg ggc ccc tgg tcc cgg gac			9312
Ala Gly Leu Pro Ala Ala Ser Leu Ala Trp Gly Pro Trp Ser Arg Asp			
	3090	3095	3100
ggc ggc atg acc ggc acc ctg acc gac gtc gac tcc agc gca tcg ccc			9360
Gly Gly Met Thr Gly Thr Leu Thr Asp Val Asp Ser Ser Ala Ser Pro			
	3105	3110	3115
ggc agg cat gcc cga act cac ccc cgc aca ggg cgt ggc ctc ttc gac			9408
Gly Arg His Ala Arg Thr His Pro Arg Thr Gly Arg Gly Leu Phe Asp			
	3125	3130	3135
gcc gcg ctg gcg gcc ggt gac gcc cac ctg ctc ccc gta cgc ttc gac			9456
Ala Ala Leu Ala Ala Gly Asp Ala His Leu Leu Pro Val Arg Phe Asp			
	3140	3145	3150
tgg gcg tcc ctg cgc gcc cag ggc gag gtg cca ccg ctg ttg cgc ggc			9504
Trp Ala Ser Leu Arg Ala Gln Gly Glu Val Pro Pro Leu Leu Arg Gly			
	3155	3160	3165

ctg atc agg acc cgt gcc cgg cgc tcg gcg gtc ggc ggc tcg gcc gcg Leu Ile Arg Thr Arg Ala Arg Arg Ser Ala Val Gly Gly Ser Ala Ala 3170 3175 3180	9552
gca gcc ggc ctg gtg gga cgc ctg agc gga cgg gga acg gtg gag cgg Ala Ala Gly Leu Val Gly Arg Leu Ser Gly Arg Gly Thr Val Glu Arg 3185 3190 3195 3200	9600
cgc gag gtg ctc ctg gac ctg gta cgg gcc cag atc gcg gtc gtc ctg Arg Glu Val Leu Leu Asp Leu Val Arg Ala Gln Ile Ala Val Val Leu 3205 3210 3215	9648
ggc cac gcg aac ccg gag acg atc gag tcc acc cgt gtc ttc cag gac Gly His Ala Asn Pro Glu Thr Ile Glu Ser Thr Arg Val Phe Gln Asp 3220 3225 3230	9696
ctc ggc ttc gac tcc ctg acc gcg gtc gaa ctc cgc aac cgc ctc aac Leu Gly Phe Asp Ser Leu Thr Ala Val Glu Leu Arg Asn Arg Leu Asn 3235 3240 3245	9744
aac gcg acc ggc ctg cgc ctt tcg gcc acc gcc gtc ttc gac tac ccc Asn Ala Thr Gly Leu Arg Leu Ser Ala Thr Ala Val Phe Asp Tyr Pro 3250 3255 3260	9792
acg gcg gac gcg ctc gtc gac ttc ctg ctg gac gag ctg ttc ggc gcg Thr Ala Asp Ala Leu Val Asp Phe Leu Leu Asp Glu Leu Phe Gly Ala 3265 3270 3275 3280	9840
cag gag gag gcc gag ctg ccg gcg ccg gtg ccg tca ccg gcg ggg gcc Gln Glu Glu Ala Glu Leu Pro Ala Pro Val Pro Ser Pro Ala Gly Ala 3285 3290 3295	9888
gcc gac gac ccg gtc gtg atc gtc ggc atg agc tgc cgc tac ccg ggc Ala Asp Asp Pro Val Val Ile Val Gly Met Ser Cys Arg Tyr Pro Gly 3300 3305 3310	9936
ggc gtc ggc tcg ccc gag gac ctg tgg cgc ctg gtg tcg gag ggc gtg Gly Val Gly Ser Pro Glu Asp Leu Trp Arg Leu Val Ser Glu Gly Val 3315 3320 3325	9984
gac gcg gtg tcc gac ttc ccc acc gac cgt gga tgg gac gtg gag agc Asp Ala Val Ser Asp Phe Pro Thr Asp Arg Gly Trp Asp Val Glu Ser 3330 3335 3340	10032
ctc tac agc ccc gac ccc gag gcg ctc ggc acc tcg tac acc cgc tcc Leu Tyr Ser Pro Asp Pro Glu Ala Leu Gly Thr Ser Tyr Thr Arg Ser 3345 3350 3355 3360	10080
ggc gga ttc ctc cac gag gcg gcg gag ttc gac ccc gat ttc ttc ggg Gly Gly Phe Leu His Glu Ala Ala Glu Phe Asp Pro Asp Phe Phe Gly 3365 3370 3375	10128
atg agc ccg cgc gag gcg ctg gcg acc gac gcc cag cag cgg ctg ctg Met Ser Pro Arg Glu Ala Leu Ala Thr Asp Ala Gln Gln Arg Leu Leu 3380 3385 3390	10176
ctg gag acg acc tgg gag gcc atc gag cgc acg ggc atc gac ccg gcg Leu Glu Thr Thr Trp Glu Ala Ile Glu Arg Thr Gly Ile Asp Pro Ala 3395 3400 3405	10224

tcg ctg cgg ggc agc cgt acg ggc gtc ttc gcg ggc gtg atg tac acc	10272
Ser Leu Arg Gly Ser Arg Thr Gly Val Phe Ala Gly Val Met Tyr Thr	
3410 3415 3420	
gac tac ggc gac ctc ctc gtc ggc gac cag ttc gag ggc tac cgc agc	10320
Asp Tyr Gly Asp Leu Leu Val Gly Asp Gln Phe Glu Gly Tyr Arg Ser	
3425 3430 3435 3440	
aac ggc agc gcg gcc agc atc gcc tcc ggc cgg gtc tcg tac acc ttc	10368
Asn Gly Ser Ala Ala Ser Ile Ala Ser Gly Arg Val Ser Tyr Thr Phe	
3445 3450 3455	
ggt ttc gag ggt ccg gcg gtc acg gtg gac acg gca tgc tcg tcg tcc	10416
Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser Ser	
3460 3465 3470	
ctg gtc gcc ctg cac tgg gcg gcg cag tcg ctg cgc tcg ggc gag tgc	10464
Leu Val Ala Leu His Trp Ala Ala Gln Ser Leu Arg Ser Gly Glu Cys	
3475 3480 3485	
tcg ctc gcg gtc gcg ggc ggt gtg acg gtg atg tcc aca ccg acg acg	10512
Ser Leu Ala Val Ala Gly Gly Val Thr Val Met Ser Thr Pro Thr Thr	
3490 3495 3500	
ttc gtc gag ttc tcg cgg caa cgc gga ctg tcg gcg gac ggc cgc tgc	10560
Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ser Ala Asp Gly Arg Cys	
3505 3510 3515 3520	
aag gcg ttc gcc gat gcg gcc gac ggc gtc ggc tgg ggc gag ggc gtc	10608
Lys Ala Phe Ala Asp Ala Ala Asp Gly Val Gly Trp Gly Glu Gly Val	
3525 3530 3535	
ggc atg ctc gta ctg gag cgt ctg tcg gac gcg cgc cgc aac ggg cac	10656
Gly Met Leu Val Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly His	
3540 3545 3550	
cgg gtg ctc gcg gtg gtg cgc ggc agt gcg gtg aac cag gac ggt gcg	10704
Arg Val Leu Ala Val Val Arg Gly Ser Ala Val Asn Gln Asp Gly Ala	
3555 3560 3565	
tcc aat ggt ctg acg gcg ccg aac ggc ccc gcc cag cag cgg gtg atc	10752
Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ala Gln Gln Arg Val Ile	
3570 3575 3580	
cgg cag gcg ctg gcg agt gcg ggg ctg tcg gcg gcg gat gtg gac gcg	10800
Arg Gln Ala Leu Ala Ser Ala Gly Leu Ser Ala Ala Asp Val Asp Ala	
3585 3590 3595 3600	
gtg gag gcg cac ggt acg ggt acg acg ctg ggc gat ccg atc gag gcc	10848
Val Glu Ala His Gly Thr Gly Thr Thr Leu Gly Asp Pro Ile Glu Ala	
3605 3610 3615	
cag gcg ctg ctc gcc acg tat ggc cag gag cga cct gag gac cgg ccg	10896
Gln Ala Leu Leu Ala Thr Tyr Gly Gln Glu Arg Pro Glu Asp Arg Pro	
3620 3625 3630	
ttg ctg ctg ggg tcg gtc aaa tcc aac atc ggt cat gcg cag gcg gct	10944
Leu Leu Leu Gly Ser Val Lys Ser Asn Ile Gly His Ala Gln Ala Ala	
3635 3640 3645	
tcg ggt gtg gcg ggt gtc atc aag atg gtg ctg gcg atg cgg cac ggt	10992

Ser Gly Val Ala Gly Val Ile Lys Met Val Leu Ala Met Arg His Gly			
3650	3655	3660	
gtg ctg cct cgg acg ctg cat gtg gat gaa ccg tcg tcg cat gtc gac	11040		
Val Leu Pro Arg Thr Leu His Val Asp Glu Pro Ser Ser His Val Asp			
3665	3670	3675	3680
tgg agt gcc ggt gcc gtc gag ctg ctg acc tcc gag gcc gag tgg ccg	11088		
Trp Ser Ala Gly Ala Val Glu Leu Leu Thr Ser Glu Ala Glu Trp Pro			
3685	3690	3695	
cag ggc gag ggg ccg cgc cgc gcg gcc gtc tcc tcc ttc ggc gtc agc	11136		
Gln Gly Glu Gly Pro Arg Arg Ala Gly Val Ser Ser Phe Gly Val Ser			
3700	3705	3710	
ggg acg aac gcg cat gtg atc ctg gag cag ccc gga ccg gac gcg gcc	11184		
Gly Thr Asn Ala His Val Ile Leu Glu Gln Pro Gly Pro Asp Ala Ala			
3715	3720	3725	
gac gcc gca ccg gac gcc acg gtg acc gat ccc ggc gcg ctg gca tgg	11232		
Asp Ala Ala Pro Asp Ala Thr Val Thr Asp Pro Gly Ala Leu Ala Trp			
3730	3735	3740	
gtg ctc tcc gca cgg aac gaa gcg gcc ctg cgc tgc cag gcg gcg cgc	11280		
Val Leu Ser Ala Arg Asn Glu Ala Ala Leu Arg Cys Gln Ala Ala Arg			
3745	3750	3755	3760
ctg ctg tcc ctg gtc gcc ggc agt gac gcg ctg tgc gcg cgg gac atc	11328		
Leu Leu Ser Leu Val Ala Gly Ser Asp Ala Leu Cys Ala Arg Asp Ile			
3765	3770	3775	
ggc cac tcg ctg gtg acc ggg cgg tcg agc ttc gcc cac cgt gcg gtg	11376		
Gly His Ser Leu Val Thr Gly Arg Ser Ser Phe Ala His Arg Ala Val			
3780	3785	3790	
gtg tgg ggc cag gac cgc gac gca ctg gtg cgt gcc ctg tcc gca ctc	11424		
Val Trp Gly Gln Asp Arg Asp Ala Leu Val Arg Ala Leu Ser Ala Leu			
3795	3800	3805	
gcg gtg ggc gag gcc gac gcc ggt ctg gcg gag ggc gcg tcc ggc gcg	11472		
Ala Val Gly Glu Ala Asp Ala Gly Leu Ala Glu Gly Ala Ser Gly Ala			
3810	3815	3820	
ggg agg acg gcc ttc ctg ttc tcg ggc cag gga tca caa cgg ctg gga	11520		
Gly Arg Thr Ala Phe Leu Phe Ser Gly Gln Gly Ser Gln Arg Leu Gly			
3825	3830	3835	3840
atg gga tgg gag ttg tac gct cgc tac ccg gtg ttc gcg gac gca ttc	11568		
Met Gly Trp Glu Leu Tyr Ala Arg Tyr Pro Val Phe Ala Asp Ala Phe			
3845	3850	3855	
gac gcc gtg tgc gcg gcc ttg gac gag cac ctg gag cgc ccc ctg cgg	11616		
Asp Ala Val Cys Ala Ala Leu Asp Glu His Leu Glu Arg Pro Leu Arg			
3860	3865	3870	
gac gtg gtc tgg ggc gag gac gcg gag ctg ctg aac cag acc gcg tac	11664		
Asp Val Val Trp Gly Glu Asp Ala Glu Leu Leu Asn Gln Thr Ala Tyr			
3875	3880	3885	
gcc cag gcc ggg ctg ttc gcg atc gag gtg gcg ctg tac cgg ctg gcg	11712		
Ala Gln Ala Gly Leu Phe Ala Ile Glu Val Ala Leu Tyr Arg Leu Ala			

3890	3895	3900	
gaa tcg tgg ggc atg cgc ccg gac ttc gtg gcg ggg cat tcg atc ggt Glu Ser Trp Gly Met Arg Pro Asp Phe Val Ala Gly His Ser Ile Gly 3905 3910 3915 3920			11760
gag gtc gcc gcg gcc cat gtg tcg ggt gtc ttc tcg ctc ccg gat gcc Glu Val Ala Ala Ala His Val Ser Gly Val Phe Ser Leu Pro Asp Ala 3925 3930 3935			11808
tgt gcg ctg gtg gcg gcc cga ggc cga ctg atg cag caa ctg ccc tcc Cys Ala Leu Val Ala Ala Arg Gly Arg Leu Met Gln Gln Leu Pro Ser 3940 3945 3950			11856
ggc gcc gcg atg atg gcg atc cgg gcg acc gag gac gag gtc ctt ccg Gly Gly Ala Met Met Ala Ile Arg Ala Thr Glu Asp Glu Val Leu Pro 3955 3960 3965			11904
cat ctg gcg gaa ggc gtc tcg ctc gcg gcg gtc aat ggc ccg tcg tcg His Leu Ala Glu Gly Val Ser Leu Ala Ala Val Asn Gly Pro Ser Ser 3970 3975 3980			11952
gtc gtg atc tcg ggc gcc gag gac gcg gtg ctg gcc atc gcg gcg cac Val Val Ile Ser Gly Ala Glu Asp Ala Val Leu Ala Ile Ala Ala His 3985 3990 3995 4000			12000
ttc gcg ggg gag ggg cgc aaa acc acc cga ctg cgg gtc tcg cat gcc Phe Ala Gly Glu Gly Arg Lys Thr Thr Arg Leu Arg Val Ser His Ala 4005 4010 4015			12048
ttc cac tcg ccg ctc atg gaa ccg atg ctg gag gaa ttc cgc gcg gtg Phe His Ser Pro Leu Met Glu Pro Met Leu Glu Glu Phe Arg Ala Val 4020 4025 4030			12096
gtg aca cgg ctg tcc ttc ggc acg ccg acg atc ccc gtc gtc tcc aac Val Thr Arg Leu Ser Phe Gly Thr Pro Thr Ile Pro Val Val Ser Asn 4035 4040 4045			12144
ctg acg ggc cgc ctc gcc gaa ccc gaa cag ctc gcg cac gcc gac tac Leu Thr Gly Arg Leu Ala Glu Pro Glu Gln Leu Ala His Ala Asp Tyr 4050 4055 4060			12192
tgg gtc cgg cac gtc cgc gag gca gtg cgc ttc gcg gac ggg ata cag Trp Val Arg His Val Arg Glu Ala Val Arg Phe Ala Asp Gly Ile Gln 4065 4070 4075 4080			12240
gcg ctg cgg gcg gaa ggg gtg acg cgg ttc ctg gag ctc ggc ccg gac Ala Leu Arg Ala Glu Gly Val Thr Arg Phe Leu Glu Leu Gly Pro Asp 4085 4090 4095			12288
ggg gtg ctg tcg gcg atg gcc cgc gag tcg gca tcg gac gac gcc gtg Gly Val Leu Ser Ala Met Ala Arg Glu Ser Ala Ser Asp Ala Val 4100 4105 4110			12336
ctc gcg ccc gta ctg cgc agg gac cgg ccc gag gag acg gcg ctg ctg Leu Ala Pro Val Leu Arg Arg Asp Arg Pro Glu Glu Thr Ala Leu Leu 4115 4120 4125			12384
ggc gcc ctg gcg cag ctg tac gtc cgg ggt gcg cac gtg gac tgg acg Gly Ala Leu Ala Gln Leu Tyr Val Arg Gly Ala His Val Asp Trp Thr 4130 4135 4140			12432

gtg	ccg	ttc	gcc	ggg	tgc	ggg	gcg	cgc	tgg	gcg	gat	ctg	ccg	acg	tac	12480
Val	Pro	Phe	Ala	Gly	Ser	Gly	Ala	Arg	Trp	Ala	Asp	Leu	Pro	Thr	Tyr	
4145					4150					4155					4160	
gcg	ttc	cag	cac	gag	cgg	ttc	tgg	ccg	tgc	ggc	ggg	gtg	gca	cgt	ccg	12528
Ala	Phe	Gln	His	Glu	Arg	Phe	Trp	Pro	Ser	Gly	Gly	Val	Ala	Arg	Pro	
			4165					4170					4175			
ggc	gat	gtg	cgg	tcc	gcg	ggc	ctg	ggc	tgc	gcc	ggg	cat	ccg	ctg	ctg	12576
Gly	Asp	Val	Arg	Ser	Ala	Gly	Leu	Gly	Ser	Ala	Gly	His	Pro	Leu	Leu	
		4180					4185					4190				
ggc	gcg	gcg	gtg	gaa	ctg	gcg	ggc	tgc	ggc	ggc	ctg	ttg	ttc	acg	ggc	12624
Gly	Ala	Ala	Val	Glu	Leu	Ala	Gly	Ser	Gly	Gly	Leu	Leu	Phe	Thr	Gly	
	4195					4200					4205					
cgg	ctg	tgc	gtg	tcc	tgc	cac	ccg	tgg	ctg	gcg	gac	cat	gtg	gtg	ctg	12672
Arg	Leu	Ser	Val	Ser	Ser	His	Pro	Trp	Leu	Ala	Asp	His	Val	Val	Leu	
	4210				4215					4220						
ggc	tcc	gtc	ctc	gtg	ccc	ggc	acc	gcg	ctg	gtg	gaa	ctg	gtg	ctg	cgg	12720
Gly	Ser	Val	Leu	Val	Pro	Gly	Thr	Ala	Leu	Val	Glu	Leu	Val	Leu	Arg	
4225				4230				4235						4240		
gcg	gcc	gac	gag	gcc	ggc	tgt	gac	ctc	ctg	gag	gag	ctg	acg	ctc	gcc	12768
Ala	Ala	Asp	Glu	Ala	Gly	Cys	Asp	Leu	Leu	Glu	Glu	Leu	Thr	Leu	Ala	
			4245			4250						4255				
gca	ccg	ctg	gtg	ctg	ccc	gcc	tgc	ggc	gcc	gcg	gtc	cag	gtt	cag	gta	12816
Ala	Pro	Leu	Val	Leu	Pro	Ala	Ser	Gly	Ala	Ala	Val	Gln	Val	Gln	Val	
	4260					4265					4270					
gcg	gtg	ggc	gag	ccc	gat	gag	gcg	ggc	cgc	cgg	ccg	gtc	tgc	gtc	cat	12864
Ala	Val	Gly	Glu	Pro	Asp	Glu	Ala	Gly	Arg	Arg	Pro	Val	Ser	Val	His	
	4275					4280					4285					
gca	cgt	gag	ggc	gag	ggc	cca	tgg	acg	ctg	cac	gcc	agt	ggg	gcg	gtg	12912
Ala	Arg	Glu	Gly	Glu	Gly	Pro	Trp	Thr	Leu	His	Ala	Ser	Gly	Ala	Val	
	4290				4295				4300							
acc	tgc	ggc	gcc	gaa	gtg	ccc	ccc	ttc	gac	gcc	acc	gta	tgg	ccg	ccc	12960
Thr	Ser	Gly	Ala	Glu	Val	Pro	Pro	Phe	Asp	Ala	Thr	Val	Trp	Pro	Pro	
4305				4310				4315						4320		
aag	ggc	gcg	gag	ccc	gtg	gac	gtg	gcg	gac	tgc	tac	gac	gta	ctc	gcc	13008
Lys	Gly	Ala	Glu	Pro	Val	Asp	Val	Ala	Asp	Cys	Tyr	Asp	Val	Leu	Ala	
			4325			4330					4335					
gat	gcc	ggg	ctc	acc	tac	ggc	ccg	gcc	ttc	cac	ggc	ctg	caa	gcg	gcc	13056
Asp	Ala	Gly	Leu	Thr	Tyr	Gly	Pro	Ala	Phe	His	Gly	Leu	Gln	Ala	Ala	
		4340				4345										



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Val Thr Trp Asp Pro Ser Gly Thr Val Leu Ile Thr Gly Gly Thr Gly		
4625	4630	4635
4640		
ggg ctg ggc cgt agt gtc gcc cgg cac ttg gtg agc gag cac ggg gtg	13968	
Gly Leu Gly Arg Ser Val Ala Arg His Leu Val Ser Glu His Gly Val		
4645	4650	4655
cgc agt ctg ctg ctg gtc agc cgc cgt ggt ccc gcg gcc gag ggt gcc	14016	
Arg Ser Leu Leu Leu Val Ser Arg Arg Gly Pro Ala Ala Glu Gly Ala		
4660	4665	4670
ggg gag ttg gtg gcc gaa ctc agg ggc agt ggc gcc gag gtg gtc atc	14064	
Gly Glu Leu Val Ala Glu Leu Arg Gly Ser Gly Ala Glu Val Val Ile		
4675	4680	4685
gag gct tgt gat gtg acc gat gcg gtg gcg gtg gcc gat ctg gtg gct	14112	
Glu Ala Cys Asp Val Thr Asp Ala Val Ala Val Ala Asp Leu Val Ala		
4690	4695	4700
cgg cat cgg atc agt gct gtg gtg cat acg gcc ggt gtt ctg gat gac	14160	
Arg His Arg Ile Ser Ala Val Val His Thr Ala Gly Val Leu Asp Asp		
4705	4710	4715
4720		
ggt gtg gtg gag tcg ctg acg ccg gag cgg ctt gcg gtg gtg ttg cgt	14208	
Gly Val Val Glu Ser Leu Thr Pro Glu Arg Leu Ala Val Val Leu Arg		
4725	4730	4735
ccg aag gtg gat gcg gcc tgg aac ctg cac gag gcg acc agg ggt ctg	14256	
Pro Lys Val Asp Ala Ala Trp Asn Leu His Glu Ala Thr Arg Gly Leu		
4740	4745	4750
gat ctg gat gcg ttt gtg gtg ttc tcg tcc gtg gca ggc act ttc ggc	14304	
Asp Leu Asp Ala Phe Val Val Phe Ser Ser Val Ala Gly Thr Phe Gly		
4755	4760	4765
agt gcg ggt cag gcc aat tac gcg gcg ggt aat gct ttc ctg gac gcg	14352	
Ser Ala Gly Gln Ala Asn Tyr Ala Ala Gly Asn Ala Phe Leu Asp Ala		
4770	4775	4780
ctg gcg tat cac cgt cgg gcg gtg ggt ctg ccg gcg gtg tcg ctg gcg	14400	
Leu Ala Tyr His Arg Arg Ala Val Gly Leu Pro Ala Val Ser Leu Ala		
4785	4790	4795
4800		
tgg ggc cct tgg tcg cag gac ggt ggt atg acc ggc acc ttg agc gac	14448	
Trp Gly Pro Trp Ser Gln Asp Gly Gly Met Thr Gly Thr Leu Ser Asp		
4805	4810	4815
gcc gat gtc cag cgc atc gcc cgg cag ggc atg ccg ccg ctg acc gtc	14496	
Ala Asp Val Gln Arg Ile Ala Arg Gln Gly Met Pro Pro Leu Thr Val		
4820	4825	4830
gag gag ggt ctg gcc ctc ttc gac gcc gcg ctc ggc agc gcc gaa ccc	14544	
Glu Glu Gly Leu Ala Leu Phe Asp Ala Ala Leu Gly Ser Ala Glu Pro		
4835	4840	4845
atg gca ctc ccg gtc cgc ctg gac ctg gcg gcg ctg ccg gca caa ggc	14592	
Met Ala Leu Pro Val Arg Leu Asp Leu Ala Ala Leu Arg Ala Gln Gly		
4850	4855	4860
gag ccc cag cca ctg ctg cgc ggc ctc atc ccg acg agg acc cgc ccg	14640	
Glu Pro Gln Pro Leu Leu Arg Gly Leu Ile Arg Thr Arg Thr Arg Arg		

4865	4870	4875	4880	
tcc ggc gcc gcc gcg gca tcc ggc atc gcg cag cgc ctt gcc ggg ctg				14688
Ser Gly Ala Ala Ala Ala Ser Gly Ile Ala Gln Arg Leu Ala Gly Leu				
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Ser Thr Ala Glu Arg Arg Glu Ala Leu Leu Asp Val Val Arg Ala Gln				
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atc gcg acg gtc ctg ggc cac gcc ggc ccg gaa acg atc gcc cct gac				14784
Ile Ala Thr Val Leu Gly His Ala Gly Pro Glu Thr Ile Ala Pro Asp				
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cgg gcc ttc cag gac ctc ggc ctc gac tcc ctg acg gcg atc gaa ctc				14832
Arg Ala Phe Gln Asp Leu Gly Leu Asp Ser Leu Thr Ala Ile Glu Leu				
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cgt aac ctg ctc ggc aag gcc acc ggg ctg cgg ctc ccg gca acg acc				14880
Arg Asn Leu Leu Gly Lys Ala Thr Gly Leu Arg Leu Pro Ala Thr Thr				
4945		4950	4955	4960
gtg ttc gac tac ccg acg gtg gat gcc ctg gcc gcc cac ctc ttg gac				14928
Val Phe Asp Tyr Pro Thr Val Asp Ala Leu Ala Ala His Leu Leu Asp				
4965		4970	4975	
gaa ctg ttc ggc gcg gag acg ggg acc gcg acg gag acg ccc ctc ccg				14976
Glu Leu Phe Gly Ala Glu Thr Gly Thr Ala Thr Glu Thr Pro Leu Pro				
4980		4985	4990	
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Val Pro Gly Leu Pro Ser Leu Ala Asp Asp Pro Val Val Ile Val Gly				
4995		5000	5005	
atg agc tgc cgc ttc ccc ggc ggc gtc gcc tgc ccg gag gac ctg tgg				15072
Met Ser Cys Arg Phe Pro Gly Gly Val Ala Ser Pro Glu Asp Leu Trp				
5010		5015	5020	
cgc ctg gtg gcg gac ggc gtg gac gcc gtc tcc gcc ttc ccg acc gac				15120
Arg Leu Val Ala Asp Gly Val Asp Ala Val Ser Ala Phe Pro Thr Asp				
5025		5030	5035	5040
cgg ggc tgg gag atc gac gac acc tac gac ccc gag cgg gag ggc gcc				15168
Arg Gly Trp Glu Ile Asp Asp Thr Tyr Asp Pro Glu Arg Glu Gly Ala				
5045		5050	5055	
atc gcc acc cgt tcc ggt gga ttc ctc cac gac gcg gcg gag ttc gac				15216
Ile Ala Thr Arg Ser Gly Gly Phe Leu His Asp Ala Ala Glu Phe Asp				
5060		5065	5070	
ccc gag ttc ttc ggg atg agc ccg cgc gag gcc ctg acc acc gac gcc				15264
Pro Glu Phe Phe Gly Met Ser Pro Arg Glu Ala Leu Thr Thr Asp Ala				
5075		5080	5085	
cag cag cgg ctg ttg ctg gag acg acc tgg gag gcg ctg gag cgc gcc				15312
Gln Gln Arg Leu Leu Leu Glu Thr Thr Trp Glu Ala Leu Glu Arg Ala				
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ggt atg gac ccg gcc acg ctc cgc ggc agc cgc acg ggt gtc ttc gcc				15360
Gly Met Asp Pro Ala Thr Leu Arg Gly Ser Arg Thr Gly Val Phe Ala				
5105		5110	5115	5120

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gag ggc tac cag ggc agc ggc agc gca ggc agt gtg gcc tcg ggc cgg Glu Gly Tyr Gln Gly Ser Gly Ser Ala Gly Ser Val Ala Ser Gly Arg 5140 5145 5150	15456
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gat ccg atc gag gcc cag gcg ctg ctc gcg acg tat ggc cag gag ccg Asp Pro Ile Glu Ala Gln Ala Leu Leu Ala Thr Tyr Gly Gln Glu Arg 5315 5320 5325	15984
ccg gag gac ccg ccg ttg ctg ctc ggc tcc gtg aag tcc aac atc ggt Pro Glu Asp Arg Pro Leu Leu Leu Gly Ser Val Lys Ser Asn Ile Gly 5330 5335 5340	16032
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Ser Ser His Val Asp Trp Ser Ala Gly Ala Val Glu Leu Leu Thr Ser	
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Glu Ala Glu Trp Pro Gln Gly Glu Gly Pro Arg Arg Ala Gly Val Ser	
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Ser Phe Gly Ile Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Pro	
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Glu Pro Val Ala Ala Glu Thr Glu Ser Ile Thr Pro Asp Thr Ala Pro	
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Asp Ala Ala Glu Asp Glu Ala Ala Asp Ser Gly Thr Pro Val Pro Ala	
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Leu Leu Ser Gly Arg Ser Ala Ser Ala Leu Arg Ala Gln Ala Ala Arg	
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Ala Tyr Ser Leu Ala Thr Gly Arg Ser Ala Phe Pro His Arg Ala Val	
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Ile Leu Ala Ala Asn Arg Ala Asp Leu Leu His Ser Leu Ser Ala Leu	
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Arg Ser Gly Lys Leu Ala Phe Leu Phe Ser Gly Gln Gly Ser Gln Arg	
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Leu Gly Met Gly Arg Glu Leu Tyr Gly Arg Tyr Pro Ala Phe Ala Glu	
5555 5560 5565	
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Ala Leu Asp Ala Val Cys Ala Ala Leu Asp Ala His Leu Asp Arg Pro	
5570 5575 5580	
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Leu Arg Asp Val Ile Trp Gly Glu Asp Ala Glu Leu Leu Asn Arg Thr	
5585 5590 5595 5600	
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Gly Tyr Ala Gln Thr Gly Leu Phe Ala Ile Glu Val Ala Leu Phe Arg	
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Leu Leu Glu Ser Trp Gly Val Arg Pro Asp His Leu Leu Gly His Ser	
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5630	
atc gga gaa atc gcc gcg gcc cat gtg gcg ggc gtc ctc tcc ctc ccg	16944
Ile Gly Glu Ile Ala Ala Ala His Val Ala Gly Val Leu Ser Leu Pro	
5635	5640
5645	
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Asp Ala Cys Ala Leu Val Ala Ala Arg Gly Arg Leu Met Gln Gln Leu	
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5660	
ccg tcc ggc ggc gcg atg atg gcg atc cgg gcg acc gag gac gag gtc	17040
Pro Ser Gly Gly Ala Met Met Ala Ile Arg Ala Thr Glu Asp Glu Val	
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5675	5680
ctt ccg cat ctg gcg gaa ggc gtc tcg ctc gcg gcg gtc aac ggg ccg	17088
Leu Pro His Leu Ala Glu Gly Val Ser Leu Ala Ala Val Asn Gly Pro	
5685	5690
5695	
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Ser Ser Val Val Val Ser Gly Ala Glu Asp Glu Val Leu Ala Leu Ala	
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Ala His Phe Glu Glu Glu Gly Arg Lys Thr Thr Arg Leu Arg Val Ser	
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cac gcc ttc cac tcc ccg ctc atg gaa ccg atg ctg gcc gac ttc cgg	17232
His Ala Phe His Ser Pro Leu Met Glu Pro Met Leu Ala Asp Phe Arg	
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Ala Val Ala Asp Gly Met Thr Tyr Ala Ala Pro Arg Ile Pro Val Val	
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Ser Asn Val Thr Gly Arg Pro Ala Thr Ala Glu Glu Leu Cys Cys Ala	
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Val Gly Ala Leu Arg Glu Gln Gly Val Thr Thr Phe Leu Glu Leu Gly	
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Pro Asp Gly Ser Leu Ser Ala Leu Ala Ala Glu Ser Ala Ala Asp Asp	
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Ser Val Leu Ala Pro Val Leu Arg Lys Asn Arg Pro Glu Ala Pro Ala	
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Leu Leu Thr Ala Leu Ala Arg Leu His Ala Gln Gly Thr Pro Val Asp	

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Trp Ser Ala Ala Phe Ala Gly Thr Gly Ala Arg Trp Val Asp Leu Pro			
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Thr Tyr Ala Phe Gln His Glu Arg Phe Trp Pro Ser Gly Gly Ala Ala			
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Leu Leu Gly Ala Ala Val Glu Leu Ala Gly Ser Gly Gly Arg Leu Leu			
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Thr Gly Arg Leu Ser Leu Ser Ser His Pro Trp Leu Ala Asp His Val			
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Val Leu Gly Ser Val Leu Val Pro Gly Thr Ala Leu Met Glu Leu Val			
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Leu Arg Ala Ala Asp Glu Val Asp Cys Ala Ala Val Asp Glu Leu Thr			
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Leu Ala Ala Pro Leu Val Leu Pro Ala Ser Gly Ala Ala Ile Gln Val			
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Gln Val Trp Val Gly Glu Pro Asp Glu Ala Gly Arg Arg Pro Val Ser			
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Val His Ala Arg Glu Gly Glu Gly Pro Trp Thr Leu His Ala Asp Gly			
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Ala Leu Ala Pro Ala Ala Glu Thr Val Pro Phe Asp Thr Ala Ile Trp			
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Pro Pro Gln Gly Ala Glu His Leu Asp Ala Ala Gly Cys Tyr Glu Arg			
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Phe Ala Asp Ala Gly Phe Ala Tyr Gly Pro Val Phe Gln Gly Leu Arg			
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Glu Gly Thr Asp Gly Asn Ala Tyr Gly Leu His Pro Ala Leu Phe Asp			
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&lt;210&gt; 4

&lt;211&gt; 6798

&lt;212&gt; PRT

&lt;213&gt; Streptomyces natalensis

&lt;400&gt; 4

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Asp Leu His Glu Thr Arg Gln Gln Leu Asp Glu Thr Glu Ala Lys Gln
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Arg Glu Pro Leu Ala Ile Val Ser Met Ala Cys Arg Phe Pro Gly Gly
          35           40           45

Val Arg Ser Pro Glu Glu Leu Trp Glu Leu Leu Arg Asp Gly Val Asp
          50           55           60

Ala Val Ser Ser Phe Pro Arg Asn Arg Gly Trp Asp Leu Asp Ala Leu
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Tyr His Ser Asp Pro Ala His Gln Gly Thr Ser Tyr Ala Arg Glu Gly
          85           90           95

Gly Phe Leu His Asp Ala Gly Glu Phe Asp Pro Gly Phe Phe Gly Ile
          100          105          110

Ser Pro Arg Glu Ala Leu Ala Met Asp Pro Gln Gln Arg Leu Leu Leu
          115          120          125

Glu Thr Ala Trp Glu Ala Val Glu Arg Ala Gly Ile Asp Pro Glu Ser
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Leu Ala Gly Ser Arg Thr Gly Val Phe Val Gly Thr Gly His Gly Gly
          145          150          155          160

Tyr Asp Ala Glu Gly Arg Arg Arg Ala Asp Glu Val Gly Gly His Leu
          165          170          175

Leu Thr Gly Asn His Ile Ser Ile Ala Ser Gly Arg Ile Ser Tyr Val
          180          185          190

Leu Gly Leu Glu Gly Pro Ala Leu Thr Val Asp Thr Ala Cys Ser Ser
          195          200          205

Ser Leu Val Ala Leu His Leu Ala Met His Ala Leu Arg Arg Asp Glu
          210          215          220

Cys Ala Met Ala Leu Val Gly Gly Ala Thr Val Met Ser Thr Pro Gln
          225          230          235          240

Met Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ala Pro Asp Gly Arg
          245          250          255

Cys Lys Pro Phe Ala Ala Ala Ala Asp Gly Thr Gly Trp Ser Glu Gly
          260          265          270

Val Gly Leu Leu Leu Val Glu Arg Leu Ser Asp Ala Val Arg Asn Gly
          275          280          285

Tyr Pro Val Leu Ala Val Leu Lys Gly Ser Ala Val Asn Gln Asp Gly
          290          295          300

Ala Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ser Gln Gln Arg Val
          305          310          315          320

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Ile Arg Gln Ala Leu Thr Gly Ala Gly Leu Ala Ala Ser Asp Ile Asp  
 325 330 335  
 Ala Val Glu Ala His Gly Thr Gly Thr Thr Leu Gly Asp Pro Val Glu  
 340 345 350  
 Ala His Ala Leu Leu Ala Thr Tyr Gly Gln Gln Arg Ala Ala Asp Arg  
 355 360 365  
 Pro Cys Gly Leu Gly Ser Met Lys Ser Asn Ile Gly His Thr Gln Ala  
 370 375 380  
 Ala Ala Gly Ile Ala Gly Val Met Lys Met Val Leu Ala Met Arg His  
 385 390 395 400  
 Gly His Leu Pro Arg Thr Leu His Leu Asp Glu Pro Thr Gly His Val  
 405 410 415  
 Asp Trp Ser Glu Gly Asn Ala Arg Leu Leu Ala Glu Pro Glu Pro Trp  
 420 425 430  
 Pro Ser Ala Gly Arg Pro Arg Arg Ala Ala Val Ser Ser Phe Gly Ile  
 435 440 445  
 Ser Gly Thr Asn Ala His Val Ile Leu Glu Gln Ala Pro Ala His Glu  
 450 455 460  
 Ala Glu Pro Ala Pro Glu Pro Ala Ala Arg Pro Gly Ala Leu Pro Trp  
 465 470 475 480  
 Ile Leu Ser Ala Arg Thr Glu Ala Gly Leu Arg Ala Gln Ala Asp Arg  
 485 490 495  
 Leu Gly Arg His Leu Arg Asp Arg Ala Asp Leu Glu Pro Ala Ala Val  
 500 505 510  
 Ala His Ala Leu Ala Asp Thr Arg Thr Leu Met Glu His Arg Ala Val  
 515 520 525  
 Val Val Ala Gly Asp Arg Glu Glu Phe Leu Arg Gly Leu Asp Ala Leu  
 530 535 540  
 Ala Ala Gly Arg Thr Ala Asn Gly Leu Val Ser Gly Val Ala Val Lys  
 545 550 555 560  
 Ala Ala Ser Ala Phe Leu Phe Ala Gly Gln Gly Ser Gln Arg Pro Gly  
 565 570 575  
 Met Gly Arg Glu Leu His Ala Ala His Pro Val Phe Ala Thr Ala Phe  
 580 585 590  
 Asp Ala Val Cys Ala Glu Leu Asp Pro His Leu Asp Arg Pro Leu Arg  
 595 600 605  
 Asp Ile Val Phe Ala Glu Glu Gly Ser Ala Glu Ala Ala Leu Leu Asp  
 610 615 620  
 Gln Thr Ala Tyr Thr Gln Ala Ala Leu Phe Ala Leu Glu Thr Ala Leu  
 625 630 635 640  
 Phe Arg Leu Val Glu Ser Trp Gly Val Ala Pro Arg Phe Val Ala Gly

45

Gln Ala Ala Ala Asp Arg Phe Ser Tyr Arg Thr His Trp Ala Pro Arg  
 980 985 990  
 Thr Ala Ser Gly Gly Pro Thr Ala Thr Gly His Trp Leu Val Val Leu  
 995 1000 1005  
 Pro Glu Gly Gly Thr Asp Asp Pro Trp Thr Ala Arg Leu Leu Asp Ala  
 1010 1015 1020  
 Leu Asn Asp Gln Gly Leu His Thr Asp Val Arg Glu Leu Pro Ala Asp  
 1025 1030 1035 1040  
 His Glu Pro Asp Ala Trp Gly Arg His Pro Val Asp Gly Val Leu Cys  
 1045 1050 1055  
 Leu Leu Ala Leu Asp Glu Arg Pro Thr Arg Ser Cys Pro Pro Tyr Arg  
 1060 1065 1070  
 Arg Gly Leu Ala Ala Thr Thr Asn Ala Ala Ala Arg Pro Glu Gly Ala  
 1075 1080 1085  
 Gly Ile Gln Ala Pro Leu Trp Cys Val Thr Arg Gly Ala Val Ala Val  
 1090 1095 1100  
 Asp Arg His Glu Ala Leu Lys Ser Pro Leu Gln Ala Gln Thr Trp Gly  
 1105 1110 1115 1120  
 Leu Gly Arg Val Ala Ala Leu Glu Ser Pro Gln Ser Trp Gly Gly Leu  
 1125 1130 1135  
 Ile Asp Leu Pro Asp Asn Leu Asp Gly Arg Ala Val Ser Ala Leu Leu  
 1140 1145 1150  
 Ser Thr Leu Ala Gly Glu Glu Asp Gln Val Ala Val Arg Pro Ala Gly  
 1155 1160 1165  
 Val Phe Ala Arg Arg Leu Glu Arg Ile Thr Pro Gly Gly Asp Thr Gly  
 1170 1175 1180  
 Asp Arg Trp Ser Thr His Gly Thr Val Leu Val Thr Gly Gly Thr Gly  
 1185 1190 1195 1200  
 Ala Leu Gly Ala His Leu Ala His Trp Leu Ala Asp Ala Gly Ala Glu  
 1205 1210 1215  
 His Leu Val Leu Thr Gly Arg Arg Gly Pro Gln Ala Pro Gly Ala Pro  
 1220 1225 1230  
 Glu Leu Ala Ala Ala Leu Thr Asp Arg Gly Val Lys Val Thr Leu Ala  
 1235 1240 1245  
 Ala Cys Asp Ala Ala Asp Arg Asp Ala Leu Ala Ala Val Leu Ala Asp  
 1250 1255 1260  
 Ile Pro Pro His Leu Pro Leu Thr Gly Val Val His Ala Ala Gly Val  
 1265 1270 1275 1280  
 Leu Asp Asp Gly Val Leu Asp Ala Leu Thr Pro Glu Arg Phe Glu Thr  
 1285 1290 1295

Val Leu Arg Pro Lys Ala Arg Ala Ala Gln Asn Leu His Glu Leu Thr  
 1300 1305 1310  
 Gln Asp Leu Asp Leu Asp His Phe Val Leu Phe Ser Ser Ile Val Gly  
 1315 1320 1325  
 Val Leu Gly Asn Ala Gly Gln Ala Asn Tyr Ala Ala Ala Asn Ala Tyr  
 1330 1335 1340  
 Leu Asp Ala Leu Ala Glu His Arg Leu Ala Gln Gly Leu Pro Ala Thr  
 345 1350 1355 1360  
 Ser Val Ser Trp Gly Pro Gly Gln Ala Ala Ala Trp His Asp Ser Asp  
 1365 1370 1375  
 Ala Ala Asp Arg Met Ser Arg Asp Gly Leu Leu Pro Met Ala Ala Ala  
 1380 1385 1390  
 Pro Arg Arg Arg Pro Ala Pro Ala Leu Ala Gln Gly Met Thr Gln Val  
 1395 1400 1405  
 Thr Val Ala Asp Ile Asp Trp Ser Ala Tyr Ala Pro Ala Leu Thr Ala  
 1410 1415 1420  
 Val Arg Pro Ser Pro Leu Ile Gly Asp Leu Pro Glu Ala Arg Arg Ala  
 425 1430 1435 1440  
 Leu Gly Pro Ala Glu Gly Pro Arg Arg Glu Arg Ser Pro Leu Arg Asp  
 1445 1450 1455  
 Arg Ile Gly Ala Leu Pro Pro Ala Glu Gln Glu Lys Ala Phe Leu Thr  
 1460 1465 1470  
 Met Val Arg Glu Glu Ala Ala Arg Val Leu Gly His Pro Ser Pro Asp  
 1475 1480 1485  
 Thr Val Asp Ala Gln Arg Ala Phe Arg Glu Gln Gly Phe Asp Ser Leu  
 1490 1495 1500  
 Met Ala Val Asp Leu Arg Asn Arg Leu Ser Ala Ala Thr Gly Leu Arg  
 505 1510 1515 1520  
 Leu Pro Ala Thr Leu Leu Phe Asp His Pro Thr Pro Leu Ala Ala Ala  
 1525 1530 1535  
 Ala Cys Leu Arg Ser Glu Val Leu Gly Ala Ala Gly Pro Ala Thr Val  
 1540 1545 1550  
 Val Gln Ala Ser Thr Ala Ala Leu Asp Glu Pro Val Ala Ile Ile Gly  
 1555 1560 1565  
 Met Ala Cys Arg Phe Pro Gly Gly Val His Ser Pro Glu Ala Leu Trp  
 1570 1575 1580  
 Arg Leu Leu Ala Glu Gly Gly Asp Ala Ile Thr Pro Met Pro Ala Asp  
 585 1590 1595 1600  
 Arg Gly Trp Asp Leu Asp Arg Leu Tyr His Pro Asp Pro Asp His Gln  
 1605 1610 1615  
 Gly Thr Ser Tyr Ala Arg Gly Gly Gly Phe Leu Asp Gly Ala Ala Asp

1620	1625	1630
Phe Asp Ala Asp Phe Phe Gly Ile Ser Pro Arg Glu Ala Leu Ala Met 1635 1640 1645		
Asp Pro Gln Gln Arg Leu Leu Leu Glu Thr Trp Glu Val Leu Glu Gln 1650 1655 1660		
Ala Gly Ile Asp Pro Glu Ser Leu Arg Gly Ser Ser Thr Gly Val Phe 665 1670 1675 1680		
Ala Gly Thr Asn Thr Gln Asp Tyr Gly Thr Ala Leu Asp Ala Ala Gln 1685 1690 1695		
Asp Glu Ala Gly Gly His Arg Leu Thr Gly Asn Ala Met Ser Val Val 1700 1705 1710		
Ser Gly Arg Val Ser Tyr Thr Phe Gly Phe Glu Gly Pro Ala Leu Thr 1715 1720 1725		
Val Asp Thr Ala Cys Ser Ser Ser Leu Val Ala Leu His Met Ala Ala 1730 1735 1740		
Gln Ala Leu Arg Gln Gly Glu Cys Ser Leu Ala Val Ala Gly Gly Val 745 1750 1755 1760		
Thr Val Met Ala Thr Pro Ser Ser Phe Val Glu Phe Ala Arg Gln Arg 1765 1770 1775		
Gly Leu Ala Pro Asp Gly Arg Cys Lys Pro Phe Ala Ala Ala Asp 1780 1785 1790		
Gly Thr Gly Trp Ser Glu Gly Val Gly Leu Leu Leu Val Glu Arg Leu 1795 1800 1805		
Ser Asp Ala Arg Arg Asn Gly His Gln Val Leu Ala Val Val Arg Gly 1810 1815 1820		
Ser Ala Val Asn Gln Asp Gly Ala Ser Asn Gly Leu Ser Ala Pro Ser 825 1830 1835 1840		
Gly Pro Ser Gln Gln Arg Val Ile Arg Gln Ala Leu Ala Asn Ala Arg 1845 1850 1855		
Val Ala Ala Ser Glu Val Asp Ala Val Glu Ala His Gly Thr Gly Thr 1860 1865 1870		
Thr Leu Gly Asp Pro Ile Glu Ala Gln Ala Leu Leu Ala Thr Tyr Gly 1875 1880 1885		
Gln Glu Arg Pro Leu Leu Leu Gly Ala Val Lys Ser Asn Leu Gly His 1890 1895 1900		
Thr Gln Ala Ala Ala Gly Val Ala Gly Val Met Lys Met Val Leu Ala 905 1910 1915 1920		
Met Arg His Gly Met Leu Pro Arg Thr Leu His Val Asp Glu Pro Thr 1925 1930 1935		
Gly His Val Asp Trp Thr Ala Gly Ala Val Glu Leu Leu Thr Glu His 1940 1945 1950		



Thr Asp Trp Pro Glu Thr Gly His Pro Arg Arg Ala Ala Val Ser Ala  
 1955 1960 1965  
 Phe Gly Ile Ser Gly Thr Asn Ala His Val Val Leu Glu Leu Pro Ala  
 1970 1975 1980  
 Ala Glu Gln Pro Leu Val Glu Gln Pro Ser Ala Ala Glu Pro Asp Ala  
 1985 1990 1995 2000  
 Pro Ala Thr Ala Pro Asp Arg Thr Pro Thr Ala Ser Asp Gly Thr Ala  
 2005 2010 2015  
 Pro Leu Leu Leu Ser Ala Lys Ser Glu Ser Ala Leu Arg Ala Gln Ala  
 2020 2025 2030  
 Ala Arg Leu His Ser His Leu Glu Arg Asp Pro Ala Leu Arg Leu Thr  
 2035 2040 2045  
 Asp Ala Ala Tyr Thr Leu Met Thr His Arg Thr Ala Phe Ala His Arg  
 2050 2055 2060  
 Ala Ala Val Arg Ala Ala Asp His Glu Ala Ala Leu Arg Ala Leu Thr  
 065 2070 2075 2080  
 Ala Leu Ala Ala Gly Glu Ala Asp Pro Ala Val Asp Thr Gly Thr Ala  
 2085 2090 2095  
 His Thr Gly Arg Asp Ala Val Leu Phe Ser Gly Gln Gly Ser Gln Arg  
 2100 2105 2110  
 Ile Gly Met Gly Arg Glu Leu Ser Gly Arg Tyr Pro Val Phe Ala Glu  
 2115 2120 2125  
 Ala Phe Asp Thr Val Cys Ala Ala Leu Asp Glu His Leu Asp Arg Pro  
 2130 2135 2140  
 Leu Arg Asp Val Val Arg Gly Glu Asp Glu Glu Leu Leu Asn Arg Thr  
 145 2150 2155 2160  
 Val Tyr Ala Gln Ala Gly Leu Phe Ala Ile Glu Val Ala Leu Phe Arg  
 2165 2170 2175  
 Leu Val Glu Ser Trp Gly Val Arg Pro His Tyr Val Ala Gly His Ser  
 2180 2185 2190  
 Val Gly Glu Ile Ala Ala Ala His Val Ala Gly Val Phe Ser Leu Ala  
 2195 2200 2205  
 Asp Ala Cys Ala Leu Val Ala Ala Arg Gly Arg Leu Met Gln Ala Leu  
 2210 2215 2220  
 Pro Ala Gly Gly Ala Met Ala Ala Ile Arg Ala Thr Glu Asp Glu Val  
 225 2230 2235 2240  
 Leu Pro His Leu Ala Asp Ser Val Ser Ile Ala Ala Val Asn Gly Pro  
 2245 2250 2255  
 Ser Ser Val Val Val Ser Gly Ala Glu His Ala Val Leu Ser Ile Ala  
 2260 2265 2270

Ala His Phe Glu Gly Ala Gly Arg Lys Thr Thr Arg Leu Arg Val Ser  
 2275 2280 2285  
 His Ala Phe His Ser Pro Leu Met Asp Pro Met Leu Ala Asp Phe Arg  
 2290 2295 2300  
 Ala Val Ala Glu Gly Leu Thr Tyr Gly Glu Pro Glu Leu Ala Val Val  
 305 2310 2315 2320  
 Ser Asn Val Thr Gly Gln Leu Ala Thr Pro Asp Gln Leu Arg Thr Pro  
 2325 2330 2335  
 Glu Tyr Trp Val Thr His Val Arg Ala Ala Val Arg Phe Ala Asp Gly  
 2340 2345 2350  
 Ile Arg Ala Leu Gly Ala Glu Gly Val Thr Arg Phe Leu Glu Leu Gly  
 2355 2360 2365  
 Pro Asp Gly Val Leu Ser Ala Leu Ala Arg Glu Ser Ala Pro Asp Asp  
 2370 2375 2380  
 Ala Val Cys Thr Pro Val Leu Arg Lys Asp Arg Ser Glu Ala Ala Thr  
 385 2390 2395 2400  
 Leu Leu Ala Ala Leu Thr His Leu His Val His Gly Thr Glu Ile Asp  
 2405 2410 2415  
 Trp Thr Ala Phe Leu Ala Gly Arg Asp Ala His Ala Val Asp Leu Pro  
 2420 2425 2430  
 Thr Tyr Ala Phe Gln His Gln Arg Phe Trp Pro Thr Pro Asp His Thr  
 2435 2440 2445  
 Arg Thr Gly Asp Leu Gly Ala Val Gly Leu Glu Ala Thr Gly His Pro  
 2450 2455 2460  
 Leu Leu Ser Ala Ala Val Glu Leu Pro Asp Gly Glu Gly Leu Leu Phe  
 465 2470 2475 2480  
 Thr Thr Arg Leu Ser Leu Gln Thr His Pro Trp Leu Ala Gly His Val  
 2485 2490 2495  
 Val Met Gly Ser Val Leu Leu Pro Gly Thr Ala Phe Ala Glu Leu Ala  
 2500 2505 2510  
 Leu Arg Ala Ala Asp Glu Val Gly Cys Asp Arg Val Asp Glu Leu Thr  
 2515 2520 2525  
 Leu Ala Ala Pro Leu Val Leu Pro Glu His Gly Gly Val Gln Leu Gln  
 2530 2535 2540  
 Leu Arg Val Gly Pro Ala Asp Ala Ser Gly Arg Arg Thr Leu Thr Ala  
 545 2550 2555 2560  
 Arg Ser Arg Ala Glu Gly Asp Gly Asp Arg Pro Trp Val Gln His Ala  
 2565 2570 2575  
 Thr Gly Val Leu Ala Glu Gly Glu Ser Thr Pro Glu Pro Gly Tyr Asp  
 2580 2585 2590  
 Phe His Thr Glu Ser Trp Pro Pro Ala Asp Ala Ala Pro Val Glu Leu

2595	2600	2605
Ser Gly Leu Tyr Pro Asp Phe Ala Ala His Gly Phe Asp Tyr Gly Pro 2610	2615	2620
His Phe Gln Gly Leu Arg Thr Ala Trp Arg Arg Gly Asp Glu Val Phe 625	2630	2635 2640
Ala Glu Val Ala Leu Pro Ala Glu Ala Glu Gly Glu Ala Ser Ala Tyr 2645	2650	2655
Gly Leu His Pro Ala Leu Leu Asp Ala Ala Leu His Val Val Ala Phe 2660	2665	2670
Asn Gly Val Asp Arg Gly Val Val Pro Phe Ser Trp Glu Ser Val Ala 2675	2680	2685
Leu His Ala Thr Gly Ala Ser Ala Val Arg Ile Arg Val Val Arg His 2690	2695	2700
Ser Gly Asp Thr Val Ser Val Asp Val Ala Asp Thr Thr Gly Glu Pro 705	2710	2715 2720
Val Ala Ser Ile Gly Thr Leu Val Leu Arg Ala Val Ser Ala Asp Gln 2725	2730	2735
Leu Ala Gly Gly Ala Asp Pro Ala Val Arg Asp Ala Leu Phe Arg Val 2740	2745	2750
Gln Trp Asn Pro Val Arg Leu Pro Pro Ala Gly Ala Ala Val Thr Val 2755	2760	2765
Ala Thr Leu Gly Ser Leu Ala Gly Ala Pro Phe Asp Gly Tyr Pro Asp 2770	2775	2780
Leu Ala Ser Leu Ala Arg Ser Gly Arg Val Ala Gly Ala Val Leu Val 785	2790	2795 2800
Pro Val Glu Ala Gly Ala Gly Glu Val Val Ala Asp Asp Val Val Gly 2805	2810	2815
Ala Thr His Ala Thr Ala Ala Arg Ala Leu Asp Leu Ala Arg Ser Trp 2820	2825	2830
Leu Ala Asp Asp Arg Phe Ala Ala Ser Arg Leu Val Phe Val Thr Arg 2835	2840	2845
Gly Ala Val Ser Gly Ala Asp Leu Ala Gly Ala Ala Val Trp Gly Leu 2850	2855	2860
Val Arg Ser Ala Leu Ser Glu His Pro Gly Arg Phe Gly Leu Val Asp 865	2870	2875 2880
Leu Asp Asp Asp Ala Glu Leu Ala Leu Val Pro Arg Val Leu Ala Ser 2885	2890	2895
Asp Glu Pro Gln Leu Leu Val Arg Gly Gly Glu Val Leu Ala Ala Arg 2900	2905	2910
Leu Ala Arg Ala Gln Ser Ser His Ala Val Thr Trp Asp Pro Ser Gly 2915	2920	2925

Thr Val Leu Val Thr Gly Gly Thr Gly Gly Leu Gly Arg Val Met Ala  
 2930 2935 2940  
 Arg His Leu Val Val Glu His Gly Val Arg Asn Leu Leu Leu Val Ser  
 945 2950 2955 2960  
 Arg Arg Gly Pro Ala Ala Glu Gly Ala Glu Glu Leu Val Thr Glu Leu  
 2965 2970 2975  
 Arg His Ser Gly Ala Glu Val Ala Val Glu Ala Cys Asp Val Thr Asp  
 2980 2985 2990  
 Ala Ala Ala Val Ala Asp Leu Val Ala Arg His Arg Ile Ser Ala Val  
 2995 3000 3005  
 Val His Thr Ala Gly Val Leu Asp Asp Gly Val Val Glu Ser Leu Thr  
 3010 3015 3020  
 Pro Glu Arg Leu Ser Ala Val Leu Arg Pro Lys Val Asp Ala Ala Trp  
 025 3030 3035 3040  
 Asn Leu His Glu Ala Thr Arg Asp Leu Asp Leu Asp Ala Phe Val Val  
 3045 3050 3055  
 Phe Ser Ser Val Ala Gly Thr Ile Gly Ser Pro Gly Gln Ala Asn Tyr  
 3060 3065 3070  
 Ala Ala Gly Asn Ala Phe Leu Asp Ala Leu Ala His His Arg Arg Ala  
 3075 3080 3085  
 Ala Gly Leu Pro Ala Ala Ser Leu Ala Trp Gly Pro Trp Ser Arg Asp  
 3090 3095 3100  
 Gly Gly Met Thr Gly Thr Leu Thr Asp Val Asp Ser Ser Ala Ser Pro  
 105 3110 3115 3120  
 Gly Arg His Ala Arg Thr His Pro Arg Thr Gly Arg Gly Leu Phe Asp  
 3125 3130 3135  
 Ala Ala Leu Ala Ala Gly Asp Ala His Leu Leu Pro Val Arg Phe Asp  
 3140 3145 3150  
 Trp Ala Ser Leu Arg Ala Gln Gly Glu Val Pro Pro Leu Leu Arg Gly  
 3155 3160 3165  
 Leu Ile Arg Thr Arg Ala Arg Arg Ser Ala Val Gly Gly Ser Ala Ala  
 3170 3175 3180  
 Ala Ala Gly Leu Val Gly Arg Leu Ser Gly Arg Gly Thr Val Glu Arg  
 185 3190 3195 3200  
 Arg Glu Val Leu Leu Asp Leu Val Arg Ala Gln Ile Ala Val Val Leu  
 3205 3210 3215  
 Gly His Ala Asn Pro Glu Thr Ile Glu Ser Thr Arg Val Phe Gln Asp  
 3220 3225 3230  
 Leu Gly Phe Asp Ser Leu Thr Ala Val Glu Leu Arg Asn Arg Leu Asn  
 3235 3240 3245

Asn Ala Thr Gly Leu Arg Leu Ser Ala Thr Ala Val Phe Asp Tyr Pro  
 3250 3255 3260  
 Thr Ala Asp Ala Leu Val Asp Phe Leu Leu Asp Glu Leu Phe Gly Ala  
 265 3270 3275 3280  
 Gln Glu Glu Ala Glu Leu Pro Ala Pro Val Pro Ser Pro Ala Gly Ala  
 3285 3290 3295  
 Ala Asp Asp Pro Val Val Ile Val Gly Met Ser Cys Arg Tyr Pro Gly  
 3300 3305 3310  
 Gly Val Gly Ser Pro Glu Asp Leu Trp Arg Leu Val Ser Glu Gly Val  
 3315 3320 3325  
 Asp Ala Val Ser Asp Phe Pro Thr Asp Arg Gly Trp Asp Val Glu Ser  
 3330 3335 3340  
 Leu Tyr Ser Pro Asp Pro Glu Ala Leu Gly Thr Ser Tyr Thr Arg Ser  
 345 3350 3355 3360  
 Gly Gly Phe Leu His Glu Ala Ala Glu Phe Asp Pro Asp Phe Phe Gly  
 3365 3370 3375  
 Met Ser Pro Arg Glu Ala Leu Ala Thr Asp Ala Gln Gln Arg Leu Leu  
 3380 3385 3390  
 Leu Glu Thr Thr Trp Glu Ala Ile Glu Arg Thr Gly Ile Asp Pro Ala  
 3395 3400 3405  
 Ser Leu Arg Gly Ser Arg Thr Gly Val Phe Ala Gly Val Met Tyr Thr  
 3410 3415 3420  
 Asp Tyr Gly Asp Leu Leu Val Gly Asp Gln Phe Glu Gly Tyr Arg Ser  
 425 3430 3435 3440  
 Asn Gly Ser Ala Ala Ser Ile Ala Ser Gly Arg Val Ser Tyr Thr Phe  
 3445 3450 3455  
 Gly Phe Glu Gly Pro Ala Val Thr Val Asp Thr Ala Cys Ser Ser Ser  
 3460 3465 3470  
 Leu Val Ala Leu His Trp Ala Ala Gln Ser Leu Arg Ser Gly Glu Cys  
 3475 3480 3485  
 Ser Leu Ala Val Ala Gly Gly Val Thr Val Met Ser Thr Pro Thr Thr  
 3490 3495 3500  
 Phe Val Glu Phe Ser Arg Gln Arg Gly Leu Ser Ala Asp Gly Arg Cys  
 505 3510 3515 3520  
 Lys Ala Phe Ala Asp Ala Ala Asp Gly Val Gly Trp Gly Glu Gly Val  
 3525 3530 3535  
 Gly Met Leu Val Leu Glu Arg Leu Ser Asp Ala Arg Arg Asn Gly His  
 3540 3545 3550  
 Arg Val Leu Ala Val Val Arg Gly Ser Ala Val Asn Gln Asp Gly Ala  
 3555 3560 3565  
 Ser Asn Gly Leu Thr Ala Pro Asn Gly Pro Ala Gln Gln Arg Val Ile

3570	3575	3580
Arg Gln Ala Leu Ala Ser Ala Gly Leu Ser Ala Ala Asp Val Asp Ala 585	3590	3595 3600
Val Glu Ala His Gly Thr Gly Thr Thr Leu Gly Asp Pro Ile Glu Ala 3605	3610	3615
Gln Ala Leu Leu Ala Thr Tyr Gly Gln Glu Arg Pro Glu Asp Arg Pro 3620	3625	3630
Leu Leu Leu Gly Ser Val Lys Ser Asn Ile Gly His Ala Gln Ala Ala 3635	3640	3645
Ser Gly Val Ala Gly Val Ile Lys Met Val Leu Ala Met Arg His Gly 3650	3655	3660
Val Leu Pro Arg Thr Leu His Val Asp Glu Pro Ser Ser His Val Asp 665	3670	3675 3680
Trp Ser Ala Gly Ala Val Glu Leu Leu Thr Ser Glu Ala Glu Trp Pro 3685	3690	3695
Gln Gly Glu Gly Pro Arg Arg Ala Gly Val Ser Ser Phe Gly Val Ser 3700	3705	3710
Gly Thr Asn Ala His Val Ile Leu Glu Gln Pro Gly Pro Asp Ala Ala 3715	3720	3725
Asp Ala Ala Pro Asp Ala Thr Val Thr Asp Pro Gly Ala Leu Ala Trp 3730	3735	3740
Val Leu Ser Ala Arg Asn Glu Ala Ala Leu Arg Cys Gln Ala Ala Arg 745	3750	3755 3760
Leu Leu Ser Leu Val Ala Gly Ser Asp Ala Leu Cys Ala Arg Asp Ile 3765	3770	3775
Gly His Ser Leu Val Thr Gly Arg Ser Ser Phe Ala His Arg Ala Val 3780	3785	3790
Val Trp Gly Gln Asp Arg Asp Ala Leu Val Arg Ala Leu Ser Ala Leu 3795	3800	3805
Ala Val Gly Glu Ala Asp Ala Gly Leu Ala Glu Gly Ala Ser Gly Ala 3810	3815	3820
Gly Arg Thr Ala Phe Leu Phe Ser Gly Gln Gly Ser Gln Arg Leu Gly 825	3830	3835 3840
Met Gly Trp Glu Leu Tyr Ala Arg Tyr Pro Val Phe Ala Asp Ala Phe 3845	3850	3855
Asp Ala Val Cys Ala Ala Leu Asp Glu His Leu Glu Arg Pro Leu Arg 3860	3865	3870
Asp Val Val Trp Gly Glu Asp Ala Glu Leu Leu Asn Gln Thr Ala Tyr 3875	3880	3885
Ala Gln Ala Gly Leu Phe Ala Ile Glu Val Ala Leu Tyr Arg Leu Ala 3890	3895	3900

Glu Ser Trp Gly Met Arg Pro Asp Phe Val Ala Gly His Ser Ile Gly  
 905 3910 3915 3920  
 Glu Val Ala Ala Ala His Val Ser Gly Val Phe Ser Leu Pro Asp Ala  
 3925 3930 3935  
 Cys Ala Leu Val Ala Ala Arg Gly Arg Leu Met Gln Gln Leu Pro Ser  
 3940 3945 3950  
 Gly Gly Ala Met Met Ala Ile Arg Ala Thr Glu Asp Glu Val Leu Pro  
 3955 3960 3965  
 His Leu Ala Glu Gly Val Ser Leu Ala Ala Val Asn Gly Pro Ser Ser  
 3970 3975 3980  
 Val Val Ile Ser Gly Ala Glu Asp Ala Val Leu Ala Ile Ala Ala His  
 985 3990 3995 4000  
 Phe Ala Gly Glu Gly Arg Lys Thr Thr Arg Leu Arg Val Ser His Ala  
 4005 4010 4015  
 Phe His Ser Pro Leu Met Glu Pro Met Leu Glu Glu Phe Arg Ala Val  
 4020 4025 4030  
 Val Thr Arg Leu Ser Phe Gly Thr Pro Thr Ile Pro Val Val Ser Asn  
 4035 4040 4045  
 Leu Thr Gly Arg Leu Ala Glu Pro Glu Gln Leu Ala His Ala Asp Tyr  
 4050 4055 4060  
 Trp Val Arg His Val Arg Glu Ala Val Arg Phe Ala Asp Gly Ile Gln  
 065 4070 4075 4080  
 Ala Leu Arg Ala Glu Gly Val Thr Arg Phe Leu Glu Leu Gly Pro Asp  
 4085 4090 4095  
 Gly Val Leu Ser Ala Met Ala Arg Glu Ser Ala Ser Asp Asp Ala Val  
 4100 4105 4110  
 Leu Ala Pro Val Leu Arg Arg Asp Arg Pro Glu Glu Thr Ala Leu Leu  
 4115 4120 4125  
 Gly Ala Leu Ala Gln Leu Tyr Val Arg Gly Ala His Val Asp Trp Thr  
 4130 4135 4140  
 Val Pro Phe Ala Gly Ser Gly Ala Arg Trp Ala Asp Leu Pro Thr Tyr  
 145 4150 4155 4160  
 Ala Phe Gln His Glu Arg Phe Trp Pro Ser Gly Gly Val Ala Arg Pro  
 4165 4170 4175  
 Gly Asp Val Arg Ser Ala Gly Leu Gly Ser Ala Gly His Pro Leu Leu  
 4180 4185 4190  
 Gly Ala Ala Val Glu Leu Ala Gly Ser Gly Gly Leu Leu Phe Thr Gly  
 4195 4200 4205  
 Arg Leu Ser Val Ser Ser His Pro Trp Leu Ala Asp His Val Val Leu  
 4210 4215 4220

Gly Ser Val Leu Val Pro Gly Thr Ala Leu Val Glu Leu Val Leu Arg  
 225 4230 4235 4240  
 Ala Ala Asp Glu Ala Gly Cys Asp Leu Leu Glu Glu Leu Thr Leu Ala  
 4245 4250 4255  
 Ala Pro Leu Val Leu Pro Ala Ser Gly Ala Ala Val Gln Val Gln Val  
 4260 4265 4270  
 Ala Val Gly Glu Pro Asp Glu Ala Gly Arg Arg Pro Val Ser Val His  
 4275 4280 4285  
 Ala Arg Glu Gly Glu Gly Pro Trp Thr Leu His Ala Ser Gly Ala Val  
 4290 4295 4300  
 Thr Ser Gly Ala Glu Val Pro Pro Phe Asp Ala Thr Val Trp Pro Pro  
 305 4310 4315 4320  
 Lys Gly Ala Glu Pro Val Asp Val Ala Asp Cys Tyr Asp Val Leu Ala  
 4325 4330 4335  
 Asp Ala Gly Leu Thr Tyr Gly Pro Ala Phe His Gly Leu Gln Ala Ala  
 4340 4345 4350  
 Trp Lys Leu Gly Gly Asp Val Tyr Ala Glu Ala Lys Leu Pro Glu Ser  
 4355 4360 4365  
 Thr Asp Gly Asp Ala Tyr Gly Leu His Pro Ala Leu Phe Asp Ala Ala  
 4370 4375 4380  
 Leu His Ala Ser Ala Leu Gly Gly Ala Glu Ala Gly Gly Val Pro Phe  
 385 4390 4395 4400  
 Ser Trp Ala Gly Val Ser Leu His Ala Thr Gly Ala Ser His Leu Arg  
 4405 4410 4415  
 Val Arg Ile Arg Glu Ala Gly Gly Ala Leu Ser Val Ala Ile Ala Asp  
 4420 4425 4430  
 Thr Ser Gly Ala Pro Val Ala Ser Val Glu Ser Leu Val Ile Arg Pro  
 4435 4440 4445  
 Leu Ser Ala Gly Gln Val Gln Ala Ala Asp Arg Asp Ala Leu Phe Lys  
 4450 4455 4460  
 Ala Asp Trp Val Pro Val Pro Leu Thr Asp Glu Arg Val Glu Pro Gly  
 465 4470 4475 4480  
 Thr Gly Pro Glu Gly Glu Pro Leu Arg Thr Tyr Ala Asp Leu Asp Ser  
 4485 4490 4495  
 Leu Glu Gly Ala Ala Val Pro Gly Thr Val Leu Val Ala Pro Pro Ser  
 4500 4505 4510  
 Gly Ala Ala Gly Thr Val Glu Ser Val His Ala Ala Thr Val Trp Ala  
 4515 4520 4525  
 Leu Glu Met Val Gln Ala Trp Leu Ala Asp Asp Arg Phe Ala Thr Ser  
 4530 4535 4540  
 Arg Leu Val Phe Val Thr Arg Gly Ala Ala Phe Gly Ala Asp Leu Ala



545	4550	4555	4560
Ala Ala Ala Val Arg Gly Leu Val Arg Ser Ala Gln Ser Glu Asn Pro	4565	4570	4575
Gly Arg Phe Gly Leu Val Asp Met Asp Gly Asp Ala Asp Thr Thr Val	4580	4585	4590
Pro Ala Gln Ala Leu Ala Thr Asp Glu Pro Glu Leu Leu Val Arg Gly	4595	4600	4605
Gly Glu Val Leu Ala Ala Arg Leu Val Arg Ala Gln Ser Ser His Thr	4610	4615	4620
Val Thr Trp Asp Pro Ser Gly Thr Val Leu Ile Thr Gly Gly Thr Gly	625	4630	4635 4640
Gly Leu Gly Arg Ser Val Ala Arg His Leu Val Ser Glu His Gly Val	4645	4650	4655
Arg Ser Leu Leu Leu Val Ser Arg Arg Gly Pro Ala Ala Glu Gly Ala	4660	4665	4670
Gly Glu Leu Val Ala Glu Leu Arg Gly Ser Gly Ala Glu Val Val Ile	4675	4680	4685
Glu Ala Cys Asp Val Thr Asp Ala Val Ala Val Ala Asp Leu Val Ala	4690	4695	4700
Arg His Arg Ile Ser Ala Val Val His Thr Ala Gly Val Leu Asp Asp	705	4710	4715 4720
Gly Val Val Glu Ser Leu Thr Pro Glu Arg Leu Ala Val Val Leu Arg	4725	4730	4735
Pro Lys Val Asp Ala Ala Trp Asn Leu His Glu Ala Thr Arg Gly Leu	4740	4745	4750
Asp Leu Asp Ala Phe Val Val Phe Ser Ser Val Ala Gly Thr Phe Gly	4755	4760	4765
Ser Ala Gly Gln Ala Asn Tyr Ala Ala Gly Asn Ala Phe Leu Asp Ala	4770	4775	4780
Leu Ala Tyr His Arg Arg Ala Val Gly Leu Pro Ala Val Ser Leu Ala	785	4790	4795 4800
Trp Gly Pro Trp Ser Gln Asp Gly Gly Met Thr Gly Thr Leu Ser Asp	4805	4810	4815
Ala Asp Val Gln Arg Ile Ala Arg Gln Gly Met Pro Pro Leu Thr Val	4820	4825	4830
Glu Glu Gly Leu Ala Leu Phe Asp Ala Ala Leu Gly Ser Ala Glu Pro	4835	4840	4845
Met Ala Leu Pro Val Arg Leu Asp Leu Ala Ala Leu Arg Ala Gln Gly	4850	4855	4860
Glu Pro Gln Pro Leu Leu Arg Gly Leu Ile Arg Thr Arg Thr Arg Arg	865	4870	4875 4880

Ser Gly Ala Ala Ala Ala Ser Gly Ile Ala Gln Arg Leu Ala Gly Leu  
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 Val Phe Asp Tyr Pro Thr Val Asp Ala Leu Ala Ala His Leu Leu Asp  
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Ser Thr Pro Leu Thr Phe Val Glu Phe Ser Arg Gln Gly Gly Leu Ser  
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 Trp Ala Glu Gly Ala Gly Ile Leu Val Leu Glu Arg Leu Ser Asp Ala  
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 265 5270 5275 5280  
 Gln Gln Arg Val Ile Arg Gln Ala Leu Ala Ser Ala Gly Leu Ser Ala  
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 Ala Asp Val Asp Ala Val Glu Ala His Gly Thr Gly Thr Thr Leu Gly  
 5300 5305 5310  
 Asp Pro Ile Glu Ala Gln Ala Leu Leu Ala Thr Tyr Gly Gln Glu Arg  
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 Pro Glu Asp Arg Pro Leu Leu Leu Gly Ser Val Lys Ser Asn Ile Gly  
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 His Ala Gln Ala Ala Ser Gly Val Ala Gly Val Ile Lys Met Val Leu  
 345 5350 5355 5360  
 Ala Met Arg His Gly Val Leu Pro Arg Thr Leu His Val Asp Glu Pro  
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 Ser Ser His Val Asp Trp Ser Ala Gly Ala Val Glu Leu Leu Thr Ser  
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 5395 5400 5405  
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 Glu Pro Val Ala Ala Glu Thr Glu Ser Ile Thr Pro Asp Thr Ala Pro  
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 Asp Ala Ala Glu Asp Glu Ala Ala Asp Ser Gly Thr Pro Val Pro Ala  
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 Ala Tyr Ser Leu Ala Thr Gly Arg Ser Ala Phe Pro His Arg Ala Val  
 5490 5495 5500  
 Ile Leu Ala Ala Asn Arg Ala Asp Leu Leu His Ser Leu Ser Ala Leu  
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 Ala Glu Gly His Thr Glu Ala Pro Ala Val Val Ala Gln Asp Arg Ala

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5540										5545										5550									
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Asp	Ala	Cys	Ala	Leu	Val	Ala	Ala	Arg	Gly	Arg	Leu	Met	Gln	Gln	Leu														
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Leu	Pro	His	Leu	Ala	Glu	Gly	Val	Ser	Leu	Ala	Ala	Val	Asn	Gly	Pro														
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Ser	Asn	Val	Thr	Gly	Arg	Pro	Ala	Thr	Ala	Glu	Glu	Leu	Cys	Cys	Ala														
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Glu	Tyr	Trp	Val	Gly	His	Val	Arg	Glu	Ala	Val	Arg	Phe	Ala	Asp	Gly														
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Val	Gly	Ala	Leu	Arg	Glu	Gln	Gly	Val	Thr	Thr	Phe	Leu	Glu	Leu	Gly														
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Pro	Asp	Gly	Ser	Leu	Ser	Ala	Leu	Ala	Ala	Glu	Ser	Ala	Ala	Asp	Asp														
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Ser	Val	Leu	Ala	Pro	Val	Leu	Arg	Lys	Asn	Arg	Pro	Glu	Ala	Pro	Ala														
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Leu	Leu	Thr	Ala	Leu	Ala	Arg	Leu	His	Ala	Gln	Gly	Thr	Pro	Val	Asp														
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 Thr Tyr Ala Phe Gln His Glu Arg Phe Trp Pro Ser Gly Gly Ala Ala  
 5875 5880 5885  
 Arg Ala Gly Asp Val Arg Ser Ala Gly Leu Gly Ser Ala Gly His Pro  
 5890 5895 5900  
 Leu Leu Gly Ala Ala Val Glu Leu Ala Gly Ser Gly Gly Arg Leu Leu  
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 Thr Gly Arg Leu Ser Leu Ser Ser His Pro Trp Leu Ala Asp His Val  
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 Val Leu Gly Ser Val Leu Val Pro Gly Thr Ala Leu Met Glu Leu Val  
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 Leu Arg Ala Ala Asp Glu Val Asp Cys Ala Ala Val Asp Glu Leu Thr  
 5955 5960 5965  
 Leu Ala Ala Pro Leu Val Leu Pro Ala Ser Gly Ala Ala Ile Gln Val  
 5970 5975 5980  
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 985 5990 5995 6000  
 Val His Ala Arg Glu Gly Glu Gly Pro Trp Thr Leu His Ala Asp Gly  
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 Ala Ala Leu His Ala Ala Leu Leu Gly Gly Glu Gly Thr Asp Glu Ala  
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 Ala Val Pro Phe Ser Trp Asn Gly Val Thr Leu His Ala Thr Gly Ala  
 6115 6120 6125  
 Ser Arg Val Arg Val Arg Ile Arg Pro Thr Glu Gly Gly Thr Ser Ile  
 6130 6135 6140  
 Ala Leu Val Asp Thr Ala Gly Ala Pro Val Ala Ser Val Arg Ser Leu  
 145 6150 6155 6160  
 Thr Ala Arg Pro Ile Thr Ala Gly Gln Leu Gln Thr Gly Asp Arg Asp  
 6165 6170 6175

Ser Leu Phe Gln Val Asp Trp Thr Thr Leu His Leu Thr Asp Glu Arg  
 6180 6185 6190  
 Ala Asn Ser Leu Ala Leu Leu Gly Lys Asp Thr Glu Gly Ile Leu Asp  
 6195 6200 6205  
 Thr Leu Ser Leu Gln Pro His Ala Asp Leu Asp Asp Leu Ala Ala Thr  
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 Gly Val His Asp Thr Val Leu Ala Pro Leu Pro Thr Arg Thr Ala Gly  
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 Thr Val Glu Ser Val His Ala Ala Thr Thr Gly Ala Leu Ala Leu Ile  
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 Arg Ser Trp Leu Ala Asp Asp Arg Phe Ala Ala Ser Arg Leu Val Phe  
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 Val Thr Arg Gly Ala Val Ser Gly Thr Asp Leu Ala Gly Ala Ser Val  
 6275 6280 6285  
 Trp Gly Leu Val Arg Ser Ala Leu Leu Glu His Pro Gly Arg Phe Gly  
 6290 6295 6300  
 Leu Val Asp Val Asp Val Asp Gln Asp Ala Glu Val Pro Leu Val Pro  
 305 6310 6315 6320  
 Arg Ala Leu Ala Ser Asp Glu Pro Gln Val Leu Val Arg Gly Gly Glu  
 6325 6330 6335  
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 6340 6345 6350  
 Trp Asp Pro Ser Gly Thr Val Leu Ile Thr Gly Gly Thr Gly Gly Leu  
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 Arg Ile Ser Ala Val Val His Thr Ala Gly Val Leu Asp Asp Gly Val  
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 Val Glu Ser Leu Thr Pro Glu Arg Leu Ser Ala Val Leu Arg Pro Lys  
 6450 6455 6460  
 Val Asp Ala Ala Trp Asn Leu His Glu Ala Thr Arg Gly Leu Asp Leu  
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 Asp Ala Phe Val Val Phe Ser Ser Val Ala Gly Thr Phe Gly Ser Ala  
 6485 6490 6495  
 Gly Gln Ala Asn Tyr Ala Ala Gly Asn Ala Phe Leu Asp Ala Leu Ala

6500	6505	6510
Tyr His Arg Arg Ala Val Gly Leu Pro Ala Val Ser Leu Ala Trp Gly 6515 6520 6525		
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Val Gln Arg Ile Ala Arg Gln Gly Met Pro Pro Leu Thr Val Glu Glu 6545 6550 6555 6560		
Gly Leu Ala Leu Phe Asp Ala Ala Leu Gly Ser Ala Glu Pro Met Ala 6565 6570 6575		
Leu Pro Val Arg Leu Asp Leu Ala Ala Leu Arg Ala Gln Gly Glu Pro 6580 6585 6590		
Gln Pro Leu Leu Arg Gly Leu Ile Arg Thr Pro Gly Arg Arg Thr Ala 6595 6600 6605		
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Thr Gly Leu Ser Ala Ala Glu Gly Arg Glu Val Val Leu Gly Ala Val 6625 6630 6635 6640		
Arg Ser Gln Ile Ala Gly Val Leu Gly His Ala Glu Ala Thr Glu Ile 6645 6650 6655		
Asp Gln Asp Arg Ala Phe Leu Asp Leu Gly Phe Asp Ser Leu Thr Ala 6660 6665 6670		
Val Glu Leu Arg Asn Arg Leu Gly Ala Val Thr Gly Ile Arg Leu Pro 6675 6680 6685		
Ala Thr Leu Leu Phe Asp Tyr Pro Thr Pro Ala Glu Leu Val Ala His 6690 6695 6700		
Leu His Ala Arg Ile Ala Pro Glu Pro Thr Val Gly Pro Glu Ala Leu 705 6710 6715 6720		
Leu Gly Glu Leu Glu Arg Met Glu Lys Ser Phe Gly Gly Leu Asp Leu 6725 6730 6735		
Thr Glu Glu Met His Glu Gln Ile Ala Gly Arg Leu Glu Val Leu Arg 6740 6745 6750		
Ala Lys Trp Asp Ala Leu Arg Asp Thr Ala Ala Ala Ala Gly His Asp 6755 6760 6765		
Gly Ser Pro Ser Asp Glu Asp Phe Asp Phe Glu Ser Ala Ser Asp Asp 6770 6775 6780		
Glu Val Phe Asp Leu Leu Asp Asn Glu Leu Gly Leu Ser 785 6790 6795		

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&lt;211&gt; 1650

&lt;212&gt; DNA

&lt;213&gt; Streptomyces natalensis

&lt;220&gt;

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&lt;222&gt; (1)..(1650)

&lt;223&gt; ORF1

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gcc ctc ggc ggc gcc gca gcc gcc gga atg acc acg atc acc tcc gcc	96
Ala Leu Gly Gly Ala Ala Ala Ala Gly Met Thr Thr Ile Thr Ser Ala	
20 25 30	
cct cat gcc gcg gcc gcc gac cgg cgc agt ccg cag gcc cgc agc gcc	144
Pro His Ala Ala Ala Ala Asp Arg Arg Ser Pro Gln Ala Arg Ser Gly	
35 40 45	
tcg ttc gta ccg gcc gtg gtg atc ggt acg gga tac ggc gcc gcg gtc	192
Ser Phe Val Pro Ala Val Val Ile Gly Thr Gly Tyr Gly Ala Ala Val	
50 55 60	
tcc gcg ctg cgg ctc ggc gag gcc gga att ccc acg ctc atg ctc gaa	240
Ser Ala Leu Arg Leu Gly Glu Ala Gly Ile Pro Thr Leu Met Leu Glu	
65 70 75 80	
atg ggc cag ctg tgg aac aag ccc gcc gac gac ggc aac gtc ttc tgc	288
Met Gly Gln Leu Trp Asn Lys Pro Ala Asp Asp Gly Asn Val Phe Cys	
85 90 95	
gga atg ctc tcg ccc gac cgc cgc tcc agc tgg ttc aag tcc cgc acc	336
Gly Met Leu Ser Pro Asp Arg Arg Ser Ser Trp Phe Lys Ser Arg Thr	
100 105 110	
gag gcc ccg ctc ggc tcg ttc ctg tgg ctg gat gtg atc aac cgc gac	384
Glu Ala Pro Leu Gly Ser Phe Leu Trp Leu Asp Val Ile Asn Arg Asp	
115 120 125	
atc gac ccg tac gcg gga gtg ctg gac aag gtg cac ttc gac cag atg	432
Ile Asp Pro Tyr Ala Gly Val Leu Asp Lys Val His Phe Asp Gln Met	
130 135 140	
tcg gtg tac gtg ggg cgg ggt gtc gcc gcc gcc tcg ctg gtc aac gcc	480
Ser Val Tyr Val Gly Arg Gly Val Gly Gly Gly Ser Leu Val Asn Gly	
145 150 155 160	
ggg atg gcc gtc gta ccg aag cgc tcg tac ttc gag gag gtc ctc ccg	528
Gly Met Ala Val Val Pro Lys Arg Ser Tyr Phe Glu Glu Val Leu Pro	
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cgg gtg gac gcc gcc gag atg tac gac cgg tac ttc ccg cgc gcc aac	576
Arg Val Asp Ala Ala Glu Met Tyr Asp Arg Tyr Phe Pro Arg Ala Asn	
180 185 190	
tcc atg ctc aag gtg aac cac atc gac aag ggg tgg ttc gag gag acg	624
Ser Met Leu Lys Val Asn His Ile Asp Lys Gly Trp Phe Glu Glu Thr	
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gag tgg tac aag ttc gcg cgg gtc tcg cgc gag cag gcg gcc aag gcg	672
Glu Trp Tyr Lys Phe Ala Arg Val Ser Arg Glu Gln Ala Gly Lys Ala	



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gtc atc tac ggc aac aac cac ggc aaa cag agc ctg gac aag acc tac Val Ile Tyr Gly Asn Asn His Gly Lys Gln Ser Leu Asp Lys Thr Tyr 260 265 270			816
ctg gcc gcc gcg ctc ggc acc ggc aag gtc acc atc gag acc ctg cac Leu Ala Ala Ala Leu Gly Thr Gly Lys Val Thr Ile Glu Thr Leu His 275 280 285			864
cag gtc agg gcg atc cac cag cag ccg gac ggc agc tac gtg ctg tcc Gln Val Arg Ala Ile His Gln Gln Pro Asp Gly Ser Tyr Val Leu Ser 290 295 300			912
gtg gac cag atc gac atg gcc ggc cag acc gtc gcc cac aag gag atc Val Asp Gln Ile Asp Thr Ala Gly Gln Thr Val Ala His Lys Glu Ile 305 310 315 320			960
tcc tgc cgt cac ctg ttc ctc ggc gcc ggc agc ctc ggc tcc acc gaa Ser Cys Arg His Leu Phe Leu Gly Ala Gly Ser Leu Gly Ser Thr Glu 325 330 335			1008
ctg ctg gtg cgc gcc cgg gac acc ggc gcg ctg ccc gac ctc aac gcc Leu Leu Val Arg Ala Arg Asp Thr Gly Ala Leu Pro Asp Leu Asn Ala 340 345 350			1056
gag gtc ggc gcg ggc tgg ggc ccc aac ggc aac atc atg acc ggc cgg Glu Val Gly Ala Gly Trp Gly Pro Asn Gly Asn Ile Met Thr Gly Arg 355 360 365			1104
gcc aac cac gtc tgg aac ccc acc ggg gcc cac cag tcc tcg atc ccc Ala Asn His Val Trp Asn Pro Thr Gly Ala His Gln Ser Ser Ile Pro 370 375 380			1152
gct ctg ggc atc gac gac tgg aac aac ccc acc gcc ccg gtc ttc gcc Ala Leu Gly Ile Asp Asp Trp Asn Asn Pro Thr Ala Pro Val Phe Ala 385 390 395 400			1200
gaa atc gcc ccg atg ccc gcc ggg ttg gag acc tgg gtc agc ctc tat Glu Ile Ala Pro Met Pro Ala Gly Leu Glu Thr Trp Val Ser Leu Tyr 405 410 415			1248
ctg gcg atc acc aag aac ccc gag cgc ggc acc ttc gtc tac gac aag Leu Ala Ile Thr Lys Asn Pro Glu Arg Gly Thr Phe Val Tyr Asp Lys 420 425 430			1296
gcc acc gac cgg gcc gcg ctg cgc tgg acg cgg gac cag aac acg ccc Ala Thr Asp Arg Ala Ala Leu Arg Trp Thr Arg Asp Gln Asn Thr Pro 435 440 445			1344
gcg gtc aac gcc gcc agg tcg ctc ttc gac cgc atc aac aag gcc aac Ala Val Asn Ala Ala Arg Ser Leu Phe Asp Arg Ile Asn Lys Ala Asn 450 455 460			1392

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ggc acg atg tac cgc tac gac ctg ttc ggg ccg cag ctg aag aac ttc 1440
Gly Thr Met Tyr Arg Tyr Asp Leu Phe Gly Pro Gln Leu Lys Asn Phe
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tcc gac gac ttc tgc tac cac ccg ctc ggc ggc tgc gtc ctg ggc aag 1488
Ser Asp Asp Phe Cys Tyr His Pro Leu Gly Gly Cys Val Leu Gly Lys
485                      490                      495

gcc acc gac ggg tac ggc cgg gtc gcc ggc tac cac aac ctc tac gtc 1536
Ala Thr Asp Gly Tyr Gly Arg Val Ala Gly Tyr His Asn Leu Tyr Val
500                      505                      510

acg gac ggc gcg ctc atc ccg ggg tcc atc ggg gtc aac ccc ttc gtg 1584
Thr Asp Gly Ala Leu Ile Pro Gly Ser Ile Gly Val Asn Pro Phe Val
515                      520                      525

acc atc acg gcg ctg gcc gag cgg aac atc gag cgg atc atc gcg gag 1632
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gac gtc aag gcc gcc tag 1650
Asp Val Lys Ala Ala
545                      550

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Pro His Ala Ala Ala Ala Asp Arg Arg Ser Pro Gln Ala Arg Ser Gly
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Ser Phe Val Pro Ala Val Val Ile Gly Thr Gly Tyr Gly Ala Ala Val
    50                      55                      60

Ser Ala Leu Arg Leu Gly Glu Ala Gly Ile Pro Thr Leu Met Leu Glu
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Met Gly Gln Leu Trp Asn Lys Pro Ala Asp Asp Gly Asn Val Phe Cys
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Gly Met Leu Ser Pro Asp Arg Arg Ser Ser Trp Phe Lys Ser Arg Thr
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Glu Ala Pro Leu Gly Ser Phe Leu Trp Leu Asp Val Ile Asn Arg Asp
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Ile Asp Pro Tyr Ala Gly Val Leu Asp Lys Val His Phe Asp Gln Met
    130                      135                      140

Ser Val Tyr Val Gly Arg Gly Val Gly Gly Gly Ser Leu Val Asn Gly
    145                      150                      155                      160

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Gly Met Ala Val Val Pro Lys Arg Ser Tyr Phe Glu Glu Val Leu Pro  
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 Arg Val Asp Ala Ala Glu Met Tyr Asp Arg Tyr Phe Pro Arg Ala Asn  
 180 185 190  
 Ser Met Leu Lys Val Asn His Ile Asp Lys Gly Trp Phe Glu Glu Thr  
 195 200 205  
 Glu Trp Tyr Lys Phe Ala Arg Val Ser Arg Glu Gln Ala Gly Lys Ala  
 210 215 220  
 Gly Leu Gly Thr Thr Phe Val Pro Asn Val Tyr Asp Phe Asp Tyr Met  
 225 230 235 240  
 Arg Arg Glu Ala Asn Gly Glu Ser Pro Lys Ser Ala Leu Ala Thr Glu  
 245 250 255  
 Val Ile Tyr Gly Asn Asn His Gly Lys Gln Ser Leu Asp Lys Thr Tyr  
 260 265 270  
 Leu Ala Ala Ala Leu Gly Thr Gly Lys Val Thr Ile Glu Thr Leu His  
 275 280 285  
 Gln Val Arg Ala Ile His Gln Gln Pro Asp Gly Ser Tyr Val Leu Ser  
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 Val Asp Gln Ile Asp Thr Ala Gly Gln Thr Val Ala His Lys Glu Ile  
 305 310 315 320  
 Ser Cys Arg His Leu Phe Leu Gly Ala Gly Ser Leu Gly Ser Thr Glu  
 325 330 335  
 Leu Leu Val Arg Ala Arg Asp Thr Gly Ala Leu Pro Asp Leu Asn Ala  
 340 345 350  
 Glu Val Gly Ala Gly Trp Gly Pro Asn Gly Asn Ile Met Thr Gly Arg  
 355 360 365  
 Ala Asn His Val Trp Asn Pro Thr Gly Ala His Gln Ser Ser Ile Pro  
 370 375 380  
 Ala Leu Gly Ile Asp Asp Trp Asn Asn Pro Thr Ala Pro Val Phe Ala  
 385 390 395 400  
 Glu Ile Ala Pro Met Pro Ala Gly Leu Glu Thr Trp Val Ser Leu Tyr  
 405 410 415  
 Leu Ala Ile Thr Lys Asn Pro Glu Arg Gly Thr Phe Val Tyr Asp Lys  
 420 425 430  
 Ala Thr Asp Arg Ala Ala Leu Arg Trp Thr Arg Asp Gln Asn Thr Pro  
 435 440 445  
 Ala Val Asn Ala Ala Arg Ser Leu Phe Asp Arg Ile Asn Lys Ala Asn  
 450 455 460  
 Gly Thr Met Tyr Arg Tyr Asp Leu Phe Gly Pro Gln Leu Lys Asn Phe  
 465 470 475 480

Ser Asp Asp Phe Cys Tyr His Pro Leu Gly Gly Cys Val Leu Gly Lys  
 485 490 495

Ala Thr Asp Gly Tyr Gly Arg Val Ala Gly Tyr His Asn Leu Tyr Val  
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Thr Asp Gly Ala Leu Ile Pro Gly Ser Ile Gly Val Asn Pro Phe Val  
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Asp Val Lys Ala Ala  
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<223> ORF2

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 Asp Phe Pro Gln Arg Lys Pro Gly Val Pro Phe Pro Pro Pro Asp Tyr  
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gcc gac tac cgc gac cgg aag ggg ctc gtc ctc tcg cag ctg tcc gac 144  
 Ala Asp Tyr Arg Asp Arg Lys Gly Leu Val Leu Ser Gln Leu Ser Asp  
 35 40 45

ggc aaa cgg gta tgg ctg gtc acc cgg cac gag gac gta cgc gcc gta 192  
 Gly Lys Arg Val Trp Leu Val Thr Arg His Glu Asp Val Arg Ala Val  
 50 55 60

ctg acc agc ccg agc atc agc tcg aac ccc gag cac aag gga ttt ccc 240  
 Leu Thr Ser Pro Ser Ile Ser Ser Asn Pro Glu His Lys Gly Phe Pro  
 65 70 75 80

aac gtc ggg aac ctg ggt gtg ccc aag cag gac cag atc ccg ggc tgg 288  
 Asn Val Gly Asn Leu Gly Val Pro Lys Gln Asp Gln Ile Pro Gly Trp  
 85 90 95

ttc gtg ggc atg gac tcc ccc gag cac gac cgg ttc cgc aag gcc ctc 336  
 Phe Val Gly Met Asp Ser Pro Glu His Asp Arg Phe Arg Lys Ala Leu  
 100 105 110

atc ccg gag ttc acc gtc cgg cgg gta cgc gcg atg aag ccc gcg atc 384  
 Ile Pro Glu Phe Thr Val Arg Arg Val Arg Ala Met Lys Pro Ala Ile  
 115 120 125

gaa cgc acg gtg gac gcc caa ctg gac gcc atg ctg gcc gcg ggc aac 432  
 Glu Arg Thr Val Asp Ala Gln Leu Asp Ala Met Leu Ala Ala Gly Asn

130	135	140	
acc gcc gac ctc gtc gcc gac ttc gcc ctg ccc atc ccc tcc ctg gtg			480
Thr Ala Asp Leu Val Ala Asp Phe Ala Leu Pro Ile Pro Ser Leu Val			
145	150	155	160
atc tcc gca ctg ctc ggc gtg ccg ccc gcc gac cgc gag ttc ttc gag			528
Ile Ser Ala Leu Leu Gly Val Pro Pro Ala Asp Arg Glu Phe Phe Glu			
165	170		175
tcc agg acc cgc gtc ctg gtc tcc ctc cgc tcc tcc acc gac gac gac			576
Ser Arg Thr Arg Val Leu Val Ser Leu Arg Ser Ser Thr Asp Asp Asp			
180	185		190
cgg atg gcc gcc gcc aag gac ctc ctg cgg tac atc aac cgg ctc gtg			624
Arg Met Ala Ala Ala Lys Asp Leu Leu Arg Tyr Ile Asn Arg Leu Val			
195	200		205
gag atc aaa cag aag tgg ggc ggc gac gac ctc atc acc cgg ctg ctg			672
Glu Ile Lys Gln Lys Trp Gly Gly Asp Asp Leu Ile Thr Arg Leu Leu			
210	215		220
gcc acc ggt gcc atc gcc ccc cac gaa atg tcc ggc gtg ctg atg ctc			720
Ala Thr Gly Ala Ile Ala Pro His Glu Met Ser Gly Val Leu Met Leu			
225	230	235	240
ctg ctc atc gcc ggc cac gag acc acg gcc aac aac atc gcc ctc ggc			768
Leu Leu Ile Ala Gly His Glu Thr Thr Ala Asn Asn Ile Ala Leu Gly			
245	250		255
gtg gtc acc ctg ctg gcg aac ccc caa tgg atc ggc gac gac cgg gcc			816
Val Val Thr Leu Leu Ala Asn Pro Gln Trp Ile Gly Asp Asp Arg Ala			
260	265		270
gtg gag gag acc ctg cgc ttc cac tcc gtc gcc gac ctg gtg tcc ctg			864
Val Glu Glu Thr Leu Arg Phe His Ser Val Ala Asp Leu Val Ser Leu			
275	280		285
cgc gtc gcg gtc cag gac gtg gaa atc gcc ggg cag ctc atc aag gcg			912
Arg Val Ala Val Gln Asp Val Glu Ile Ala Gly Gln Leu Ile Lys Ala			
290	295	300	
ggc gag gga atc gtg ccg ctg gtc gcc gcc gcc aat cat gac gag aac			960
Gly Glu Gly Ile Val Pro Leu Val Ala Ala Ala Asn His Asp Glu Asn			
305	310	315	320
gcc ttc gaa tgc ccc cac gcc ttc gac ccg tcc cgg tcc gcc cgc cac			1008
Ala Phe Glu Cys Pro His Ala Phe Asp Pro Ser Arg Ser Ala Arg His			
325	330		335
cat gtg gcc ttc ggc tac ggc gta cac caa tgc ctg gga cag aac ctg			1056
His Val Ala Phe Gly Tyr Gly Val His Gln Cys Leu Gly Gln Asn Leu			
340	345		350
gtg cgg atc gag atg gaa gtc gcg tac cgg aaa ctc ttc gag cgc atc			1104
Val Arg Ile Glu Met Glu Val Ala Tyr Arg Lys Leu Phe Glu Arg Ile			
355	360		365
ccg aac ctc gaa ctc gcc gtg ccc acc gac ggg ttg gac atc aag tac			1152
Pro Asn Leu Glu Leu Ala Val Pro Thr Asp Gly Leu Asp Ile Lys Tyr			
370	375	380	

gac ggc gtg ctc tac ggc ctg aac gag ctg ccc gtc cgc tgg tag 1197  
 Asp Gly Val Leu Tyr Gly Leu Asn Glu Leu Pro Val Arg Trp  
 385 390 395

<210> 8  
 <211> 399  
 <212> PRT  
 <213> Streptomyces natalensis

<400> 8  
 Met Thr Tyr Thr Asp Pro Ala Ala Pro Glu Thr Asp Pro Pro Ala Val  
 1 5 10 15

Asp Phe Pro Gln Arg Lys Pro Gly Val Pro Phe Pro Pro Asp Tyr  
 20 25 30

Ala Asp Tyr Arg Asp Arg Lys Gly Leu Val Leu Ser Gln Leu Ser Asp  
 35 40 45

Gly Lys Arg Val Trp Leu Val Thr Arg His Glu Asp Val Arg Ala Val  
 50 55 60

Leu Thr Ser Pro Ser Ile Ser Ser Asn Pro Glu His Lys Gly Phe Pro  
 65 70 75 80

Asn Val Gly Asn Leu Gly Val Pro Lys Gln Asp Gln Ile Pro Gly Trp  
 85 90 95

Phe Val Gly Met Asp Ser Pro Glu His Asp Arg Phe Arg Lys Ala Leu  
 100 105 110

Ile Pro Glu Phe Thr Val Arg Arg Val Arg Ala Met Lys Pro Ala Ile  
 115 120 125

Glu Arg Thr Val Asp Ala Gln Leu Asp Ala Met Leu Ala Ala Gly Asn  
 130 135 140

Thr Ala Asp Leu Val Ala Asp Phe Ala Leu Pro Ile Pro Ser Leu Val  
 145 150 155 160

Ile Ser Ala Leu Leu Gly Val Pro Pro Ala Asp Arg Glu Phe Phe Glu  
 165 170 175

Ser Arg Thr Arg Val Leu Val Ser Leu Arg Ser Ser Thr Asp Asp Asp  
 180 185 190

Arg Met Ala Ala Ala Lys Asp Leu Leu Arg Tyr Ile Asn Arg Leu Val  
 195 200 205

Glu Ile Lys Gln Lys Trp Gly Gly Asp Asp Leu Ile Thr Arg Leu Leu  
 210 215 220

Ala Thr Gly Ala Ile Ala Pro His Glu Met Ser Gly Val Leu Met Leu  
 225 230 235 240

Leu Leu Ile Ala Gly His Glu Thr Thr Ala Asn Asn Ile Ala Leu Gly  
 245 250 255

Val Val Thr Leu Leu Ala Asn Pro Gln Trp Ile Gly Asp Asp Arg Ala

260 265 270

Val Glu Glu Thr Leu Arg Phe His Ser Val Ala Asp Leu Val Ser Leu  
275 280 285

Arg Val Ala Val Gln Asp Val Glu Ile Ala Gly Gln Leu Ile Lys Ala  
290 295 300

Gly Glu Gly Ile Val Pro Leu Val Ala Ala Ala Asn His Asp Glu Asn  
305 310 315 320

Ala Phe Glu Cys Pro His Ala Phe Asp Pro Ser Arg Ser Ala Arg His  
325 330 335

His Val Ala Phe Gly Tyr Gly Val His Gln Cys Leu Gly Gln Asn Leu  
340 345 350

Val Arg Ile Glu Met Glu Val Ala Tyr Arg Lys Leu Phe Glu Arg Ile  
355 360 365

Pro Asn Leu Glu Leu Ala Val Pro Thr Asp Gly Leu Asp Ile Lys Tyr  
370 375 380

Asp Gly Val Leu Tyr Gly Leu Asn Glu Leu Pro Val Arg Trp  
385 390 395

<210> 9  
<211> 1194  
<212> DNA  
<213> Streptomyces natalensis

<220>  
<221> CDS  
<222> (1)..(1194)  
<223> ORF3

<400> 9

atg acc gcc gcc tcc cac gac ctg ccc tgc ctc aac ctc gaa ccg ccc	48
Met Thr Ala Ala Ser His Asp Leu Pro Cys Leu Asn Leu Glu Pro Pro	
1 5 10 15	
aaa atg ctg aaa ctg agc ccg ctg ctg cgc gcc ttg cag gac cgg ggg	96
Lys Met Leu Lys Leu Ser Pro Leu Leu Arg Ala Leu Gln Asp Arg Gly	
20 25 30	
ccg atc cac cgg gtg cgc aca ccc gcc ggg gac gag gcg tgg ctg gtg	144
Pro Ile His Arg Val Arg Thr Pro Ala Gly Asp Glu Ala Trp Leu Val	
35 40 45	
acc cgc cac gcc gag ctc aag cag ctg ctg cac gac gag cgc atc ggc	192
Thr Arg His Ala Glu Leu Lys Gln Leu Leu His Asp Glu Arg Ile Gly	
50 55 60	
cgc acg cac ccc gac ccg ccc tcc gcc gcc cag tac gta cgc agc ccc	240
Arg Thr His Pro Asp Pro Pro Ser Ala Ala Gln Tyr Val Arg Ser Pro	
65 70 75 80	
ttc ctg gac ctg ctg atc agc gac gcc gac gcc gag tcc ggg cgt cgg	288
Phe Leu Asp Leu Leu Ile Ser Asp Ala Asp Ala Glu Ser Gly Arg Arg	
85 90 95	

cag cac gcc gag acc cgc cgc ctg ctc act ccg ttg ttc tcg gcc cgg	336
Gln His Ala Glu Thr Arg Arg Leu Leu Thr Pro Leu Phe Ser Ala Arg	
100 105 110	
cgc gtt ctg gaa atg cag ccg aag gtg gag gag gcc gcg gac acc ctg	384
Arg Val Leu Glu Met Gln Pro Lys Val Glu Glu Ala Ala Asp Thr Leu	
115 120 125	
ctg gac gcg ttc atc gcc cag ggg cct ccc ggc gac ctg cac ggc gag	432
Leu Asp Ala Phe Ile Ala Gln Gly Pro Pro Gly Asp Leu His Gly Glu	
130 135 140	
ctc acc gtg ccg ttc gcc ctc acg gtc ctc tgc gag gtc atc ggc gtg	480
Leu Thr Val Pro Phe Ala Leu Thr Val Leu Cys Glu Val Ile Gly Val	
145 150 155 160	
ccg ccg cag cgc cgc gcg gag ctg acc aca ctg ctg gcc ggt atc gcc	528
Pro Pro Gln Arg Arg Ala Glu Leu Thr Thr Leu Leu Ala Gly Ile Ala	
165 170 175	
aag ctg gac gac cgc gag ggc gcc gta cgg gca cag gac gac ctg ttc	576
Lys Leu Asp Asp Arg Glu Gly Ala Val Arg Ala Gln Asp Asp Leu Phe	
180 185 190	
ggg tac gtg gca ggg ctg gtc gag cac aag cgg gcc gag ccc ggc cca	624
Gly Tyr Val Ala Gly Leu Val Glu His Lys Arg Ala Glu Pro Gly Pro	
195 200 205	
gac atc atc tcc cgg ctg aac gac ggc gag ctg acc gag gac cgc gtg	672
Asp Ile Ile Ser Arg Leu Asn Asp Gly Glu Leu Thr Glu Asp Arg Val	
210 215 220	
gca cac ctg gcc atg ggc ctg ctg ttc gcc ggg ctg gac agc gtc gcg	720
Ala His Leu Ala Met Gly Leu Leu Phe Ala Gly Leu Asp Ser Val Ala	
225 230 235 240	
agc atc atg gac aac ggg gtg gtg ctg ctg gcc gcc cac ccc gat cag	768
Ser Ile Met Asp Asn Gly Val Val Leu Leu Ala Ala His Pro Asp Gln	
245 250 255	
cgc gcg gcg gcg ctg gcc gac ccc gac gtg atg gcg cgt gcc gtg gag	816
Arg Ala Ala Ala Leu Ala Asp Pro Asp Val Met Ala Arg Ala Val Glu	
260 265 270	
gag gtg ctg cgg acc gcc cgg gcc ggc ggg tgc gtc ctg ccg ccg cgc	864
Glu Val Leu Arg Thr Ala Arg Ala Gly Gly Ser Val Leu Pro Pro Arg	
275 280 285	
tac gcc agc gag gac atg gaa ttc ggc ggg gtg acg ata cgg gcc gga	912
Tyr Ala Ser Glu Asp Met Glu Phe Gly Gly Val Thr Ile Arg Ala Gly	
290 295 300	
gac ctg gtc ctg ttc gac ctc ggc ctg ccc aac ttc gac gag cgg gcg	960
Asp Leu Val Leu Phe Asp Leu Gly Leu Pro Asn Phe Asp Glu Arg Ala	
305 310 315 320	
ttc aca ggg ccg gag gaa ttc gac gcc gcc agg acc ccc aat ccc cat	1008
Phe Thr Gly Pro Glu Glu Phe Asp Ala Ala Arg Thr Pro Asn Pro His	
325 330 335	



ctg acc ttc ggc cac ggc atc tgg cac tgc atc ggc gcc ccc ctc gcg 1056  
 Leu Thr Phe Gly His Gly Ile Trp His Cys Ile Gly Ala Pro Leu Ala  
 340 345 350  
 cgc ctg gaa ctc agg acg atg ttc acc aag ctg ttc acc cgc ctg ccg 1104  
 Arg Leu Glu Leu Arg Thr Met Phe Thr Lys Leu Phe Thr Arg Leu Pro  
 355 360 365  
 gaa ctg cgc ccg gaa ctt ccg gtg gag caa ctg cgc ctg aag gag ggc 1152  
 Glu Leu Arg Pro Glu Leu Pro Val Glu Gln Leu Arg Leu Lys Glu Gly  
 370 375 380  
 cag ctg tgc ggc ggc ttc gcc gag ctc cgg gtg gtc tgg tag 1194  
 Gln Leu Ser Gly Gly Phe Ala Glu Leu Arg Val Val Trp  
 385 390 395

&lt;210&gt; 10

&lt;211&gt; 398

&lt;212&gt; PRT

&lt;213&gt; Streptomyces natalensis

&lt;400&gt; 10

Met Thr Ala Ala Ser His Asp Leu Pro Cys Leu Asn Leu Glu Pro Pro  
 1 5 10 15

Lys Met Leu Lys Leu Ser Pro Leu Leu Arg Ala Leu Gln Asp Arg Gly  
 20 25 30

Pro Ile His Arg Val Arg Thr Pro Ala Gly Asp Glu Ala Trp Leu Val  
 35 40 45

Thr Arg His Ala Glu Leu Lys Gln Leu Leu His Asp Glu Arg Ile Gly  
 50 55 60

Arg Thr His Pro Asp Pro Pro Ser Ala Ala Gln Tyr Val Arg Ser Pro  
 65 70 75 80

Phe Leu Asp Leu Leu Ile Ser Asp Ala Asp Ala Glu Ser Gly Arg Arg  
 85 90 95

Gln His Ala Glu Thr Arg Arg Leu Leu Thr Pro Leu Phe Ser Ala Arg  
 100 105 110

Arg Val Leu Glu Met Gln Pro Lys Val Glu Glu Ala Ala Asp Thr Leu  
 115 120 125

Leu Asp Ala Phe Ile Ala Gln Gly Pro Pro Gly Asp Leu His Gly Glu  
 130 135 140

Leu Thr Val Pro Phe Ala Leu Thr Val Leu Cys Glu Val Ile Gly Val  
 145 150 155 160

Pro Pro Gln Arg Arg Ala Glu Leu Thr Thr Leu Leu Ala Gly Ile Ala  
 165 170 175

Lys Leu Asp Asp Arg Glu Gly Ala Val Arg Ala Gln Asp Asp Leu Phe  
 180 185 190

Gly Tyr Val Ala Gly Leu Val Glu His Lys Arg Ala Glu Pro Gly Pro  
 195 200 205

Asp Ile Ile Ser Arg Leu Asn Asp Gly Glu Leu Thr Glu Asp Arg Val  
 210 215 220  
 Ala His Leu Ala Met Gly Leu Leu Phe Ala Gly Leu Asp Ser Val Ala  
 225 230 235 240  
 Ser Ile Met Asp Asn Gly Val Val Leu Leu Ala Ala His Pro Asp Gln  
 245 250 255  
 Arg Ala Ala Ala Leu Ala Asp Pro Asp Val Met Ala Arg Ala Val Glu  
 260 265 270  
 Glu Val Leu Arg Thr Ala Arg Ala Gly Gly Ser Val Leu Pro Pro Arg  
 275 280 285  
 Tyr Ala Ser Glu Asp Met Glu Phe Gly Gly Val Thr Ile Arg Ala Gly  
 290 295 300  
 Asp Leu Val Leu Phe Asp Leu Gly Leu Pro Asn Phe Asp Glu Arg Ala  
 305 310 315 320  
 Phe Thr Gly Pro Glu Glu Phe Asp Ala Ala Arg Thr Pro Asn Pro His  
 325 330 335  
 Leu Thr Phe Gly His Gly Ile Trp His Cys Ile Gly Ala Pro Leu Ala  
 340 345 350  
 Arg Leu Glu Leu Arg Thr Met Phe Thr Lys Leu Phe Thr Arg Leu Pro  
 355 360 365  
 Glu Leu Arg Pro Glu Leu Pro Val Glu Gln Leu Arg Leu Lys Glu Gly  
 370 375 380  
 Gln Leu Ser Gly Gly Phe Ala Glu Leu Arg Val Val Trp  
 385 390 395

<210> 11  
 <211> 40  
 <212> DNA  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence: Forward primer  
 ermE promoter

<400> 11  
 aaactgcagc tctagaggcg gcttgcgccc gatgctagtc

40

<210> 12  
 <211> 70  
 <212> DNA  
 <213> Artificial Sequence

<220>  
 <223> Description of Artificial Sequence: Reverse primer  
 ermE promoter

<400> 12

aaactgcagc tctagatggc ccgggtatcg atcgtcgacg gcatgcggat cctaccaacc 60

ggcacgattg

70

<210> 13

<211> 30

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Forward primer ORF1

<400> 13

aggattaccc atatgttcga gaaccagcat

30

<210> 14

<211> 20

<212> DNA

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Reverse primer ORF1

<400> 14

gcatgagcgt gggaattccg

20

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